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MINERALOGICAL ABSTRACTS

Vol. 15—No. 4 December 1961

AGE DETERMINATION AND ISOTOPE MINERALOGY

NEUMANN (H.). *Apparent ages of Norwegian minerals and rocks.* Norsk. Geol. Tidsskr., 1960, **40**, 173–191.

Existing data on ages of Norwegian minerals and rocks are presented chronologically in Table I (166 determinations) and in an addendum (30 determinations). The details tabulated include: apparent age, mineral, method, authority, locality, collector or source, reference. No attempt has been made to discriminate between the items, nor have the results been recalculated for the most recent decay constants. The methods cited include Pb- α , U/Pb, Th/Pb, K/Ar, Rb/Sr, and Re/Os. The ages range from 36 m.y. (Pb- α) on zircon from Permian igneous rocks (Oslo region) to 2290 m.y. (Re/Os) on molybdenite from Lofoten. Precambrian activity seems to have taken place mostly at two periods, about 900 to 950 m.y. and 1100 m.y.; there is no indication of rock-forming events between about 1400 and 1800 m.y. The customary division of the Precambrian of South Norway into three distinct formations is not supported by the age determinations, and may prove mainly a geographical convenience and of less genetic importance than was once thought.

K. S. H.

AMIRKHANOV (KH. I.), BARTNITSKIĬ (E. N.), BRANDT (S. B.), & VOĬTKEVICH (G. V.) [Амирханов (Х. И.), Бартницкий (Е. Н.), Брандт (С. Б.), и Войткевич (Г. В.)]. О миграции аргона и гелия в некоторых породах и минералах [*On the migration of argon and helium in some rocks and minerals*]. Доклады Акад. Наук СССР. [C.R. Acad. Sci. U.S.S.R.], 1959, **126**, 160–162.

The loss on heating of ^{40}Ar and ^4He from powdered samples of a graphite schist, a hornblende, and a pyroxene was measured by an isotope dilution method, and the diffusion coeff. (D) and activation energy (E) for the processes were calculated. The pyroxene had $E = 73 \text{ kcal. deg.}^{-1}$ (at.) $^{-1}$ and D (extrapolated to normal temperatures) $= 4 \times 10^{-55}$ for both gases, and proved the most suitable for age determination; the schist showed gas losses at low temperatures.

G. R.

BUTCHER (N. E.). *Age of the orogeny and granites in south-west England.* Nature, 1961, **190**, 253.

On stratigraphical evidence, these granites are assigned to the Permian [M.A. **15**–2] rather than to the latter part of the Carboniferous period.

M. J. Le B.

DURAND (GEORGES L.). *Détermination de l'âge absolu de galènes françaises par spectrométrie de masse.* C.R. Acad. Sci., Paris, 1960, **250**, 4018–4019.

The ages determined according to the Holmes revised scale [M.A. **15**–170] include 1 Cambrian (565 ± 100 m.y.), 1 Carboniferous (300 ± 70 m.y.), 5 Permian (250 – 260 , ± 70 – 110 m.y.), 2 Jurassic (140 ± 100 & 170 ± 90 m.y.), 1 Cretaceous (100 ± 100 m.y.), 1 Eocene (50 ± 90 m.y.). They were determined by measuring the ratios $^{206}\text{Pb}/^{204}\text{Pb}$ and $^{207}\text{Pb}/^{204}\text{Pb}$.

E. J. & A. S.

DODSON (M. H.), MILLER (J. A.), & YORK (D.). *Potassium-argon ages of the Dartmoor and Shap granites using the total volume and isotopic dilution techniques of argon measurement.* Nature, 1961, **190**, 800–802.

Refined techniques have given more accurate age determinations for the Dartmoor granite (265 ± 5 m.y.) and Shap granite (397 ± 8 m.y.). [M.A. **15**–3]

M. J. Le B.

DEUTSCH (SARAH) & CHAURIS (LOUIS). *Mesure de l'âge absolu du granite du Huelgoat (Finistère).* C.R. Acad. Sci., Paris, 1960, **250**, 1298–1300.

The Huelgoat granite belongs to the Hercynian cycle. Its absolute age, determined on biotites by the K/Ar and Sr/Rb methods is 290 m.y. and 310 m.y. respectively. Biotites from the La Feuillée facies gave ages of 280 m.y. (K/Ar) and 317 m.y. (Sr/Rb).

E. J. & A. S.

DURAND (GEORGES) & LAY (CLAUDE). *Détermination de l'âge de quelques galènes de la vallée du Niari (Moyen Congo).* C.R. Acad. Sci., Paris, 1960, **251**, 750–751.

The ages from determinations on 7 specimens range from

420 to 650 m.y. (± 100). The mean age of 630 m.y. thought by G. Bigotte to be probable [Bull. Direction Mines & Géol., 1959, no. 9] is confirmed by 5 of the determinations; two measurements, 420 & 510 m.y., are definitely different.

E. J. & A. S.

SCHREINER (G. D. L.). *Age of a Pilansberg dyke of palaeomagnetic significance.* Nature, 1958, **181**, 1330–1331.

Biotite/chlorite was concentrated from a central feldspathic zone in the dyke at approx. 8000 ft. levels in the Robinson Deep mine [Transvaal]. The most probable age of the concentrated material by Sr/Rb determination is 1290 ± 180 m.y.; the significance of this determination in relation to the true age of intrusion is discussed. [M.A. **14**–314]

J. Ph.

ROSHOLT (J. N.), EMILIANI (C.), GEISS (J.), KOCZY (F. F.), & WANGERSKY (P. J.). *Absolute dating of deep-sea cores by the Pa^{231}/Th^{230} method.* Journ. Geol., 1961, **69**, 162–185, 8 figs.

Ages based on the $^{231}Pa/^{230}Th$ ratio are regarded as more dependable than some others of a similar nature because both of these are daughters of the same element and decay at different rates. It furnishes data from which the following absolute time scale is proposed:

Post-glacial	0 – 10,000 years
Late and Main Würm	10,000 – 30,000
Main-Early Würm interval	30,000 – 50,000
Early Würm	50,000 – 65,000
Riss/Würm interglacial	65,000 – 100,000
Riss	100,000 – 130,000
Mindel/Riss interglacial	130,000 – 175,000

The possible effects of contamination and changing cosmic-ray intensity are considered.

R. E. W.

TAMERS (M. A.), STIPP (J. J.), & COLLIER (J.). *High sensitivity detection of naturally occurring radiocarbon—I: Chemistry of the counting sample.* Geochim. Cosmochim. Acta, 1961, **24**, 266–276, 1 fig.

Details are given for the conversion of carbon (in a sample for dating) to carbonate, carbide, acetylene, and finally benzene, the latter being a highly suitable material for liquid scintillation counting techniques.

R. A. H.

BOWEN (ROBERT). *Paleotemperature analyses of Mesozoic Belemnoides from Germany and Poland.* Journ. Geol., 1961, **69**, 75–83, 2 figs.

^{18}O isotope analyses of the rostrum calcite of Jurassic and Cretaceous cephalopods are interpreted, on certain assumptions, in terms of the mean temperatures prevailing during their deposition, namely—Upper Jurassic (Kimmeridgian) of Germany $21^{\circ}C$; Upper Jurassic of Poland 27.7° ; Lower Cretaceous (Neocomian) of Germany 20° ; Lower Cretaceous (Albian) of France 24° ; Upper Cretaceous (Senonian) of Germany 19.8° ; Upper Cretaceous (Cenomanian) of Poland 16.8° ; Upper Cretaceous (Senonian) of Poland 21.5° ; Upper Cretaceous (Senonian, Campanian) of Poland 18.4° . It is concluded that Europe was semitropical in the Jurassic and more temperate later.

R. E. W.

HOERING (T. C.) & PARKER (P. L.). *The geochemistry of the stable isotopes of chlorine.* Geochim. Cosmochim. Acta, 1961, **23**, 186–199.

The $^{37}Cl/^{35}Cl$ ratio in 81 natural samples does not show any significant variation. The chlorine contents of several rocks are tabulated. Values for minerals include olivine 0.014, lepidolite 0.005 and 0.008, beryl 0.005 and 0.009, and sodalite 1.72 per cent. [M.A. **12**–286].

R. A. H.

APPARATUS AND TECHNIQUES

Preparatory, d.t.a., X-ray, &c.

MYERS (A. T.) & WOOD (W. H.). *Ceramic mills in a paint mixer for preparation of multiple rock samples.* Appl. Spectroscopy, 1960, **14**, 136–138.

Samples are ground without contamination by using vials and ball pestles made from a ceramic containing 96% alumina. Six vials each taking 17 to 18 ml of sample are mixed with an eccentric shaking motion at 725 cycles per min. Normal grinding time is 20 min. giving, for granite, 98.5% at –270 mesh.

R. A. H.

FLINTER (B. H.). *The magnetic separation of some alluvial minerals in Malaya.* Amer. Min., 1959, **44**, 738–751, 2 figs., 9 tables.

A series of magnetic separations of Malayan alluvial concentrates with a Frantz Isodynamic separator, model L-1 is reported. A grain size of –36 + 72 mesh B.S.S. was used with a forward slope of 15° . Amperage was varied from 0.1 to 1.4 by 0.1 steps, and side slopes of 15° , 20° , 25° , and 30° were tried, with best results at 25° . Tables include the mass magnetic susceptibilities and weight per cent. data for 15 minerals as amperage and side slope are varied.

B. H. B.

TAKANO (KOTOYO). *Refinement for the net for drawing crystal figures.* Journ. Japanese Assoc. Min. Petr. Econ. Geol., 1958, **42**, 183–187, 2 figs., 1 table, (1 Japanese).

TAKANO (YUKIO), & ITO (KAZUAKI). *On realgar from Arafune mine, Gunma Prefecture. Supplement—a new method for drawing crystal figures.* Ibid., 1957, **41**, 235–246, 6 figs., 2 tables, (in Japanese).

The earlier paper presents a morphological study of realgar from Arafune mine by two-circle goniometer. X-ray powder data of the mineral are given, and a new graphical method of crystal drawing is proposed. Crystal figures can be drawn directly from the values of ρ , ϕ of the faces which are measured by two-circle goniometer, without knowing the indices of the faces. Two kinds of Wulff net are used. One is the ordinary net; the other, called Takano's net, is a modified Wulff net, the north pole of which is in the position of $\rho=6^{\circ}23'$, $\phi=18^{\circ}26'$, the internationally adopted position for crystal drawing, of the original Wulff net. All other positions are correspondingly transposed. The drawing of the crystal by this method is simple. First, project ρ , ϕ values of the faces on to the Takano net; superimpose this net on the Wulff net; find the common great circle of two faces; the line which connects the pole of this great circle and the centre of the net is the direction of the edge between the two faces. In comparison with Parker's or Barker's method the technique described has the advantages of simplicity of drawing, no need for calculation nor knowledge of face indices, and high accuracy. An idea for a photographic goniometer for crystal measurement is also discussed.

I. S.

RIEGGER (O. K.) & VAN VLACK (L. H.). *Dihedral angle measurement.* Trans. Metall. Soc., A.I.M.E., 1960, **218**, 933–935, 5 figs.

The authors present a statistical simplification for determining dihedral angles in solids. They show that the median angle of relatively few two-dimensional observations provides a satisfactory value for dihedral angle determinations. Those data that contain bimodal or non-equilibrated dihedral angle distributions are readily detected by their method.

R. G. Wls.

ČERMÁK (J.). *Wavelength distribution of X-rays in the focus of a monochromator and an estimate of the influence of this distribution on precision measurements of lattice constants.* Czech. Journ. Phys., 1960, B **10**, 215–224, (English with Russian summary).

Wavelength distribution in the focus of a Johansson type monochromator is computed assuming that the tube focus emissivity $G(\alpha)$, reflection curve $R(\alpha)$, and wavelength distribution of the incident radiation $J(\lambda-\lambda_0)$ are known. It is shown that the centre of gravity may be shifted in accordance with the position of the crystal on the focal circle, and this may affect the precision of measurements of lattice parameters. [M.A. 15–94]

J. N.

LÍNEK (A.) & NOVÁK (C.). *Structure factor computing machine.* Czech. Journ. Phys., 1960, B **10**, 397–404, (English with Russian summary).

A special, single-purpose, relay machine for automatic series evaluation of the functions $\cos(2\eta/1024)(hx+ky+lz)$ and $\sin(2\eta/1024)(hx+ky+lz)$ and its utilization for calculating structure factor components are described.

J. N.

BADOLLET (M. S.) & MCGOURTY (J. P.). *Identification of minerals associated with asbestos by X-ray diffraction patterns.* Trans. Canad. Inst. Min. & Metall., 1958, **61**, 169–174.

X-ray diffraction patterns of serpentine, chrysotile, antigorite, brucite, iron oxide, tremolite, epidote, and quartz indicated that for complete identification of all the minerals present in asbestos samples, not only chemical analysis but also X-ray spectrographic and petrographic techniques are necessary.

R. A. H.

LILLY (A. C.), MILNE (I. H.), CANEER (W. T.), & DALZELL (J. A.). *X-ray diffractometer gear-changing mechanism.* Anal. Chem., 1960, **32**, 893, 1 fig.

Details and layout drawing are given for a gear-changing mechanism for the Philips high-angle diffractometer. Rapid selection of three different gear ratios is possible.

D. A. M.

LODDING (WILLIAM) & HAMMELL (LAURENCE). *Differential thermal analysis of hydroxides in reducing atmosphere.* Anal. Chem., 1960, **32**, 657–660, 7 figs.

A pressure vacuum furnace and d.t.a. assembly are described with the aid of photographs. The apparatus permits gas analysis of reaction products while d.t.a. is in progress. Reaction and phase changes of iron hydroxides and oxides in reducing and oxidizing atmospheres were identified. The amount of gibbsite can be determined regardless of the iron hydroxides present.

D. A. M.

Various analytical techniques

MOSS (A. A.), HEY (M. H.), & BOTHWELL (D. I.). *Methods for the chemical analysis of meteorites. I. Siderites.* Min. Mag., 1961, **32**, 802–816, 2 figs.

Simple colorimetric and gravimetric procedures for the determination of Co, Cr, Cu, Ga, Ni, P, and S in an iron meteorite or in the separated metallic phase of a pallasite are described. A procedure for the quantitative removal of the metallic, sulphide, and phosphide phases involves attack by dry chlorine at 250° to 350°C; feldspars, apatite, magnetite, and chromite are not attacked provided the chlorine is dry and free from HCl. The method is not suitable for meteorites very high in Ni.

R. A. H.

ROUBAULT (MARCEL), ROCHE (HUBERT DE LA), & GOVINDARAJU (KUPPUSAMI). *Sur analyse quantitative des roches silicatées naturelles à l'aide du spectrographe à réseau à enregistrement direct.* C.R. Acad. Sci., Paris, 1960, **250**, 2912-2914.

The first results of the application of the direct reading grating spectrograph to the rapid analysis of major elements in silicate rocks are recorded. Details are given of a method for use with various compositions of rocks and the impact of this new technique on petrography and geochemistry is discussed.

E. J. & A. S.

PLAKSIN (I. N.), SMIRNOV (V. N.), & STARCHIK (L. P.). [*Utilisation of the (α , n) reaction for quantitative determination of beryllium, boron and fluorine in ores.* Atomnaya Energiya, 1960, **9**, 361-363.] Anal. Abstr., 1961, **8**, abstr. 2287.

R. A. H.

DVORECHENSKIĬ (F. I.), KOSHELEV (I. P.), NAĬDENOV (B. M.), NEUCHESOV (S. N.), SHISHAKIN (O. V.), & SHMONIN (L. I.). [*The photo-neutron method for determining beryllium in ores.* Trudy Kaz. Nauch.-Issled. Inst. Min. Sŷr'ya, 1959, 204-211.] Anal. Abstr., 1961, **8**, abstr. 1396.

Details are given of a method for the photo-neutron determination of Be in ores. The sensitivity is 5×10^{-3} % of BeO with 10 minute measurements on a sample of 50 to 180 g.

R. A. H.

HORWOOD (J. L.). *A graphical determination of uranium and thorium in ores from their gamma-ray spectra.* Intern. Journ. Appl. Radiation & Isotopes, 1960, **9**, 16.

R. A. H.

BAILEY (N. H.) & SCHULER (V. C. O.). *Application of radioactivation analysis to gold ores of the Witwatersrand system.* South African Industr. Chem., 1960, **14**, 67-71.

The ore samples are irradiated in a neutron pile and the Au is determined from the γ -count of ^{198}Au .

R. A. H.

LENIHAN (J. M. A.). *Radioactivation analysis.* Nature, 1959, **184**, 951-952.

Report on a symposium held in Vienna from June 1st to June 3rd, 1959.

C. H. K.

GUNDLACH (H.). [*Determination of small quantities of water-soluble salts in rocks.* Tonindustr. Zeit., 1958, **82**, 292.] Brit. Ceram. Abstr., 1959, abstr. 595.

A percolator using paper filters is recommended, with photometric determination of anions.

A. G. C.

BEAMISH (F. E.). *A critical review of methods of isolating and separating the six platinum metals.* Talanta, 1960, **5**, 1-35.

Methods of assaying noble metal ores are reviewed and a new fire-assay technique, based on the reduction of the associated base metals by carbon, Na_2CO_3 , and borax at 1450°C , is reported.

[M.A. **14**-380]

R. A. H.

HÄKKINEN (I. T. P.). *A modification for washing the benzidine sulphate precipitate in the determination of sulphate.* Nature, 1960, **186**, 232.

Excess benzidine can be removed by centrifuging the benzidine sulphate microprecipitate, trapped between layers of BaSO_4 , with 1:1 alcohol-acetone mixture.

D. McK.

BENNETT (H.) & HAWLEY (W. G.). *Determination of boric oxide by the modified Wherry's method.* Trans. Brit. Ceram. Soc., 1960, **59**, 315-322.

Errors in the values for B_2O_3 as determined by Wherry's process are due to variable alkalinity in the titration solution after boiling off the CO_2 . These errors can be avoided by neutralization with HCl to methyl red before the addition of mannitol.

R. A. H.

GOLDICH (SAMUEL S.), INGAMILLS (C. OLIVER), & THAEM-LITZ (DORIS). *The chemical composition of Minnesota Lake marl—comparison of rapid and conventional chemical methods.* Econ. Geol., 1959, **54**, 285-300, 1 fig., 7 tables.

W. E. H.

TERTIPIS (G. G.) & BEAMISH (F. E.). *Separation of rhodium from iridium by copper powder.* Anal. Chem., 1960, **32**, 486-489.

Copper powder is used as a selective precipitant for rhodium in 1.0 N HCl solution of rhodium and iridium in the range from 10 mg to 50 γ . Each metal can be subsequently determined gravimetrically or colorimetrically.

D. A. M.

GHEORGHIU (C.) & RADULESCU-GRIGORE (E.). [*Determination of molybdenum in molybdates and their concentrates.* Rev. Chim., Bucharest, 1960, **11**, 415-416.] Anal. Abstr., 1961, **8**, abstr. 1014.

The method is based on the formation of $[\text{MoS}_4][\text{Cr}(\text{NH}_3)_5\text{Cl}]$, and its gravimetric estimation, after reduction of a treated solution of the mineral with H_2S .

R. A. H.

MOISEEVA (L. M.), KUZNETSOVA (N. M.), & PAL'SHINA (I. I.). [*Gravimetric determination of small amounts of beryllium in ores and their products.* Zhur. Anal. Khim., 1960, **15**, 561-563.] Anal. Abstr., 1961, **8**, abstr. 1852.

The method is based on the precipitation of Be with 2-dimethylhexane-3,5-dione. Full details are given.

R. A. H.

LOTT (PETER F.) & VITEK (RICHARD K.). *Gravimetric determination of bismuth with dimethylglyoxime*. Anal. Chem., 1960, **32**, 391-393.

The known precipitation of bismuth by dimethylglyoxime was investigated. A method was developed for the estimation of 50 to 500 mg of bismuth by precipitation with dimethylglyoxime at pH 11.5 in the presence of EDTA and potassium cyanide. The behaviour of other ions was studied. The bismuth dimethylglyoximate precipitate was investigated and a new gravimetric factor of 0.7410 assigned. The compound was found to be cubic body centered, a 9.48 Å, formula weights per cell 4, formula weight approximately 581, density approximately 4.53. X-ray powder diffraction data are listed and the strongest lines have d values of 3.37, 2.94, 2.72 Å.

D. A. M.

HAMLIN (A. G.) & ROBERTS (B. J.). *Separation of uranium by reversed phase-partition chromatography*. Nature, 1960, **185**, 527-528.

A tributyl phosphate/nitric acid column can be used to separate uranium, and gives more than 99% recovery from a wide range of cations and anions.

D. McK.

ARMICHAEL (I.) & McDONALD (A.). *The colorimetric and polarographic determination of some trace elements in the standard rocks G-1 and W-1*. Geochim. Cosmochim. Acta, 1961, **22**, 87-93.

Details are given for the decomposition of rock samples and the extraction of Cd, Co, Cu, Ni, Pb, and Zn with lithizone in CCl_4 followed by their colorimetric determination by visual comparison with standards, requiring a much smaller volume of solvent, etc., than that necessary in spectrophotometry. Bi, Cd, Cu, Pb, and Zn may also be determined polarographically. Results are quoted for determinations of these elements in G-1 and W-1. [M.A. **4-250**, **15-9**]

R. A. H.

BLEFIELD (L. I.) & VINCENT (E. A.). *Determination of cadmium in rocks by neutron-activation analysis*. Analyst, 1961, **86**, 386-391.

Cd (0.1-1 p.p.m.) is determined by separating ^{115}Cd (half-life 55 hours) from a solution of the irradiated powdered rock and counting in a beta-counter. Results are given for 13 Skaergaard rocks and for G-1 and W-1 which gave mean values of 0.06 and 0.33 p.p.m. of Cd respectively.

R. A. H.

MARTYNOVA (L. T.) & SOCHEVANOV (V. G.). [*Polarographic determination of cadmium in ores*. Zavod Lab., 1960, **26**, 792-793.] Anal. Abstr., 1961, **8**, abstr. 955.

Cd is separated from large amounts of Cu, Ni, Fe, and Al by the adsorption of the Cl^- complex of Cd from HCl on an anionite resin.

R. A. H.

STRELOW (F. W. E.). *Separation of cadmium from uranium, cobalt, nickel, manganese, zinc, copper, titanium, and other elements by cation exchange chromatography*. Anal. Chem., 1960, **32**, 363-365, 4 figs.

Experimental elution curves were made with columns of AG50W-X8, a sulfonated polystyrene resin, and with 0.5 N hydrochloric acid as eluent. Cadmium is found to be quantitatively separated from U, Co, Ni, Mn, Zn, Cu, and Ti. Other cations that can be completely separated are Mg^{2+} , Ca^{2+} , Sr^{2+} , Ba^{2+} , Fe^{2+} , Fe^{3+} , Al^{3+} , Th^{4+} , Y^{3+} , Zr^{4+} , La^{3+} and the rare earths, and Cs⁺.

D. A. M.

VAN WAMBEKE (L.) & PINTE (G.). [*Determination of scandium in wolframite by activation analysis*. Bull. Soc. Chim. France, 1960, 1901-1902.] Anal. Abstr., 1961, **8**, abstr. 2332.

To use the ^{46}Sc isotope with an 85 day half-life Sc must be separated from Fe. The precision is 10-15% and the limit of sensitivity 0.1 µg Sc per litre.

R. A. H.

TUREKIAN (K. K.) & CARR (M. H.). *Chromium, cobalt and strontium in some [U.S. National] Bureau of Standards rock reference samples*. Geochim. Cosmochim. Acta, 1961, **24**, 1-9, 1 fig.

A method for the simultaneous determination of Cr and Co in rocks by neutron activation is described. Sr is determined by an emission spectrographic method calibrated by standards determined by isotope dilution. [M.A. **15-122**]

R. A. H.

BHATNAGER (R. P.) & SHUKLA (R. P.). *Separation of silver from cobalt and nickel by ion exchange chromatography*. Anal. Chem., 1960, **32**, 777-778.

Silver is quantitatively separated from cobalt as well as from nickel with a flow rate of 8 ml per sq. cm. per minute on Amberlite I R-120 (Na) using 2% sodium nitrite as eluting agent. Application of the separation as a modification of Volhard's method for the volumetric determination of silver was shown to be successful.

D. A. M.

KRÁL (S.) & RETT (V.). [*Rapid polarographic determination of tin in ferrotungsten, metallic tungsten and tungsten ores*. Hutn. Listy, 1960, **15**, 638-639.] Anal. Abstr., 1961, **8**, abstr. 1017.

Full details are given for the solution and treatment of tungsten ores leading to the polarographic determination of tin.

R. A. H.

ODONE (G.) & PICASSO (G.). [*Polarographic analysis of traces of metals in iron ores*. Chim. e Industr., 1960, **42**, 598-605.] Anal. Abstr., 1961, **8**, abstr. 572.

Trace amounts of Cu, Pb, Zn, Ni, and Sn can be determined in iron ore in approx. 2 hours.

R. A. H.

Spectrophotometric ; colorimetric

ANDERSSON (L. H.). *The determination of silica. III. Interference from aluminium, iron and fluorine in the spectrophotometric determination of silica*. Acta Chem. Scandinavica, 1960, **14**, 1571-1579.

At 20°C and 400 m μ the presence of NaF or Al increases the minimum amount of sodium molybdate necessary for the full development of the molybdosilicate colour. At pH 1.5 the extinction of the solution when containing appreciable Fe³⁺ is a function of time. Fe may be removed by extraction at pH 4 or at pH 7.5 if fluorine is present. Acetylacetone is used as complexing agent, with CCl₄ as solvent, the organic compounds are then destroyed by fusion and the melt dissolved in water. [M.A. **14**-87, **15**-9]

R. A. H.

BLOXAM (T. W.). *The photometric determination of silica in rocks and refractory materials*. Analyst, 1961, **86**, 420-422.

The sample is fused with NaOH, the cooled melt taken up in dilute H₂SO₄, and the pH adjusted to between 3.0 and 3.1 before the development of the yellow α -form of molybdosilicic acid [M.A. **14**-317]. The effect of Fe is overcome by reference against a blank prepared from the same rock sample ; a correction is also made for P₂O₅.

R. A. H.

KEMULA (W.) & ROSOŁOWSKI (S.). [*Photometric determination of silicon as γ -molybdosilicic acid*. Chem. Anal., Warsaw, 1960, **5**, 419-428.] Anal. Abstr., 1961, **8**, abstr. 1444.

On boiling the acid solution (pH 0 to 4) of α - and β -molybdosilicic acids for 30 minutes a γ -molybdosilicic acid is formed. This form is more stable and is thus more suitable for the colorimetric determination of Si as the yellow complex at 420 m μ , since critical time and pH effects are eliminated.

R. A. H.

CHOWDHURY (A. N.) & SARMA (B. DAS). *Improved rapid determination of nickel in soils and laterites*. Anal. Chem., 1960, **32**, 820-821.

A rapid geochemical method for nickel is based on the visual comparison of a stable wine-red colour. Nickel

dimethylglyoxime is extracted by a mixed benzene-amyl alcohol solvent. The organic layer is shaken with strong alkali and more dimethylglyoxime which extracts nickel in the aqueous layer and develops the colour. Between 50 and 4000 p.p.m., the results obtained differed by less than 30% from those obtained by conventional methods.

D. A. M.

SØRENSEN (E.). *A new sensitive reagent for uranium. 2(2-Thiazolylazo)-5-dimethylaminophenol (TAM). Application to the assay of rocks and solutions low in uranium*. Acta Chem. Scandinavica, 1960, **14**, 965-968.

Uranyl nitrate is extracted into isobutyl methyl ketone from a solution saturated with aluminium nitrate. Addition of the new reagent gives an intensely coloured complex which is measured spectrophotometrically with a sensitivity of 0.1 μ g in the range 1 to 5 μ g per ml.

R. A. H.

MELOAN (C. E.), HOLKEBOER (PAUL), & BRANDT (WARREN W.). *Spectrophotometric determination of uranium with benzohydroxamic acid in 1-hexanol*. Anal. Chem., 1960, **32**, 791-793, 5 figs.

A versatile method for the quantitative determination of from 0.2 to 12 mg of uranium is based on the extraction with 1-hexanol of the coloured product formed when the uranyl ion reacts with benzohydroxamic acid at pH 6.2. The effects of diverse ions and extraction interferences were investigated.

D. A. M.

SMITH (W. B.) & DREWRY (J.). *Colorimetric determination of uranium in phosphate rock after extraction with alkyl acid phosphates*. Analyst, 1961, **86**, 178-184.

Quadrivalent uranium is extracted by a solution of lauryl acid phosphates in light petroleum, the extract is evaporated to dryness, heated with nitric, sulphuric, and perchloric acids, and U determined colorimetrically with H₂O₂.

R. A. H.

U.K.A.E.A. *Analytical method for the absorptiometric determination of uranium in solid residues from ore dissolving*. U.K. Atomic Energy Authority, 1960 Rept. PG 131(S), 7 pp.

The dried sample is treated with HF and HNO₃ and the U extracted into ethyl ether. After removal of the ether and destruction of any organic matter with HClO₄-HNO₃ the U is determined absorptiometrically in a solution containing Na₂CO₃, Na₂P₄O₇, and H₂O₂. The coefficient of variation is 0.17%.

R. A. H.

HOLCOMB (H. P.) & YOE (JOHN H.). *Spectrophotometric determination of uranium with 3-(2-Arsonophenylazo)-4,5-dihydroxy-2,7-naphthalenedisulfonic acid (Trisodium Salt)*. Anal. Chem., 1960, **32**, 612-617, 5 figs.

Uranium is separated from interfering elements by ether extraction. Uranyl ions form a stable blue complex with arsenazo reagent. The absorbance is read at 596 m μ . The method was applied to ore samples, an alloy, and a salt solution. The practical sensitivity of the method was shown to be 0.033 p.p.m. of uranium and the standard deviation obtained in the analysis of ten synthetic samples was 1.3%.

D. A. M.

SAKHAROV (A. A.). [*Determination of micro amounts of selenium in ores and rocks.* Zhur. Anal. Khim., 1960, **15**, 614-617.] Anal. Abstr., 1961, **8**, abstr. 1930.

A colorimetric method suitable for 2-30 μ g of Se: Fe > 600 mg interferes.

R. A. H.

MEDLIN (W. L.). *Colorimetric determination of zinc and cadmium with 8-quinolinol.* Anal. Chem., 1960, **32**, 632-634, 6 figs.

Colorimetric methods are described for the determination of trace amounts of zinc and cadmium in synthetic anhydrite samples. Beer's law is obeyed up to at least 10 p.p.m. for zinc and from 10 to at least 40 p.p.m. for cadmium. Interference by other ions was discussed but not investigated.

D. A. M.

JANKOVSKÝ (J.). [*Photometric determination of gold in ores and concentrates.* Hutn. Listy, 1960, **15**, 725-726.] Anal. Abstr., 1961, **8**, abstr. 938.

R. A. H.

SAVIN (S. B.), YOL'NETS (M. P.), BALASHOV (YU. A.), & BAGREEV (V. V.). [*Photometric determination of thorium in minerals with arsenazo II.* Zhur. Anal. Khim., 1960, **15**, 446-451.] Anal. Abstr., 1961, **8**, abstr. 1467.

Th may be separated by double fluoride precipitation or by fluoride-oxalate precipitation. The arsenazo II method is suitable for 10^{-2} to $10^{-4}\%$ of Th in minerals.

R. A. H.

SHIMODA (N.) & KURIYAMA (N.). [*Photometric determination of fluorine in mica by the ferric thiocyanate method.* Japan Analyst, 1959, **8**, 743-745.] Anal. Abstr., 1961, **8**, abstr. 1948.

[INGOLS et al., Anal. Chem., 1950, **22**, 799]

R. A. H.

BARNETT (PAUL R.). *An evaluation of whole-order, 1/2-order, and 1/3-order reporting in semiquantitative spectrochemical analysis.* Bull. U.S. Geol. Survey, 1961, **1084-H**, 183-206, 3 figs., 6 tables.

K. S.

MYERS (A. T.), HAVENS (R. G.), & DUNTON (P. J.). *A spectrochemical method for the semiquantitative analysis of rocks, minerals, and ores.* Bull. U.S. Geol. Survey, 1961, **1084-I**, 207-229, 1 fig., 11 tables.

A visual comparison method, reporting results to 1/3 of an order of magnitude [preceding abstract], is useful in reconnaissance studies.

K. S.

CROOK (S. R.) & WALD (S.). *Determination of arsenic in coal and coke.* Fuel, 1960, **39**, 313-322.

The sample is mixed with MgO and KMnO₄ and burned in oxygen, the As extracted with acid and reduced to AsH₃ which is absorbed and oxidized by iodine solution, and the molybdenum blue colour developed by the addition of ammonium molybdate and hydrazine sulphate is measured.

R. A. H.

CAMPBELL (ROBERT H.) & MELLON (M. G.). *Determination of bismuth based on the reduction of molybdophosphoric acid.* Anal. Chem., 1960, **32**, 54-57, 4 figs.

A new absorptiometric method is described for the determination of bismuth in the range from 0.02 to 1.2 mg. per 50 ml. It is based upon the enhancement effect of the reduction of molybdophosphoric acid by ascorbic acid. The calibration curve does not follow Beer's law but it is reproducible. A recommended general procedure is given.

D. A. M.

Flame photometric; titrimetric

ABBEY (S.) & MAXWELL (J. A.). *Determination of potassium in mica: a flame-photometric study.* Chem. Canada, 1960, **12**, 37-41.

K is determined at 766, Rb at 780, Li at 671, and Na at 589 m μ . Adsorption of K by Al₂O₃ or Fe₂O₃ is prevented by the addition of MgSO₄, but too much MgSO₄ depresses the K emission.

R. A. H.

FABRIKOVA (E. A.). [*Flame-photometric determination of small amounts of rubidium in silicates.* Zhur. Anal. Khim., 1960, **15**, 427-430.] Anal. Abstr., 1961, **8**, abstr. 1381.

The effect of Cs, K, Na, and Li on the intensity of Rb emission at 894.4 m μ in the air-acetylene flame can be minimized and the emission intensified and stabilized by the addition of K₂SO₄ solution. Full details are given.

R. A. H.

MENIS (O.). *Evaluation of flame photometry for the determination of elements of the rare-earth group.* U.S. Atomic Energy Comm., Rept. CF-52-8141, 20 pp.

R. A. H.

ENDO (Y.) & TAKAGI (H.). [*Rapid successive determination of iron (III) and aluminium in manganese ore with EDTA and CyDTA*. Japan Analyst, 1959, **8**, 829-830.] Anal. Abstr., 1961, **8**, abstr. 1953.

To avoid interference from Mn, Fe^{3+} is titrated with EDTA at pH 2-3 with salicylic acid as indicator, and Al is then titrated with CyDTA (1,2-diaminocyclohexane-*NNN'*-tetra-acetic acid) at pH 2.2 with Cu-PAN (1-(2-pyridylazo)-2-naphthol) as indicator. R. A. H.

KENNEDY (JOHN H.). *Determination of uranium (VI) by reduction to uranium (III) in a Jones reductor*. Anal. Chem., 1960, **32**, 150-152.

Uranium solutions of 0.01 M can be quantitatively reduced from U^{VI} to U^{III} in a Jones reductor. The effluent is caught in a de-aerated solution of Fe^{III} , which is back titrated with potassium dichromate. Useful titrations can be made of two elements together, such as, U with Ti, Fe or Mo. D. A. M.

LEWANDOWSKI (A.) & WITKOWSKI (H.). [*Titrimetric determination of phosphorus in apatite by means of ion-exchange resins*. Prace Kom. Mat.-Przyr. Poznan. Tow. Przyj. Nauk, 1959, **7**, 3-7.] Anal. Abstr., 1961, **8**, abstr. 1479.

The method is based on the complexometric titration of soluble phosphates in an ammoniacal medium with Eriochrome black T as indicator. R. A. H.

BHATTACHARYYA (A. C.), BHADURI (B. P.), & BANERJEE (N. G.). *Rapid complexometric determination of phosphorus in coal*. Analyst, 1961, **86**, 195-198.

P is extracted with perchloric acid, precipitated as ammonium magnesium phosphate, and the Mg determined by titration with EDTA. The maximum mean deviation of replicate determinations was 0.003%. R. A. H.

GILBERT (A. B.). *Micro determination of calcium*. Nature, 1959, **183**, 1754-1755.

The indicator for the micro determination of calcium described by the author [Nature, 1959, **183**, 88] is Eriochrome Black T and is therefore well known in this connection. This indicator can be used at pH 12-13 and calcium can therefore be determined directly in the presence of magnesium. C. H. K.

AFANAS'IEVA (L. I.). [*Separation of strontium and calcium with the use of EDTA. Determination of strontium in apatites*. Zhur. Anal. Khim., 1960, **15**, 564-567.] Anal. Abstr., 1961, **8**, abstr. 1864.

1 to 20 mg of Sr may be separated from up to 200 mg of Ca by precipitation of SrSO_4 in the presence of EDTA. For apatites an acetate buffer solution is used, with a 0.2 g sample. [M.A. **15**-176] R. A. H.

HOBSON (F.) & STEPHENSON (W. H.). *The determination of magnesium oxide and silica in magnesium trisilicate and calcined magnesite*. Analyst, 1959, **84**, 520-521.

(Ca+Mg) is determined with EDTA and solochrome black and Ca is determined with diethylamine and EDTA using Calcon indicator. R. A. H.

KONKIN (V. D.). [*Rapid determination of calcium oxide in flux agglomerate, limestone, dolomite, and blast-furnace and open-hearth slag, in the presence of triethanolamine as complexing agent*. Bull. Nauk.-Tekn. Inform. Ukr. Nauk.-Issled. Inst. Metall., 1958, no. 6, 111.] Anal. Abstr., 1959, **6**, abstr. 4300.

R. A. H.

SOUSA (A. DE). [*Determination of barium in minerals*. Chemist Analyst, 1960, **49**, 75-76.] Anal. Abstr., 1961, **8**, abstr. 1408.

Following dissolution of the sample, the HCl solution (containing 0.15 to 0.3 g Ba) is treated with $\text{K}_2\text{Cr}_2\text{O}_7$ and the BaCrO_4 is collected by filtration. The BaCrO_4 is then dissolved, the Cr precipitated out with ammonia, and the filtrate titrated with EDTA. R. A. H.

BIBLIOGRAPHIES AND BOOK NOTICES

BASSETT (D. A.). *Bibliography and index of geology and allied sciences for Wales and the Welsh Borders, 1897-1958*. Cardiff (Nat. Mus. of Wales), 1961, 378 pp., 140 figs. Price 42s.

R. A. H.

DEAN (J. A.). *Flame photometry*. New York (McGraw-Hill), 1961, 354 pp. Price 89s.

R. A. H.

BUERGER (M. J.). *Crystal-structure analysis*. London & New York (John Wiley), 1960, xvii+668 pp., 329 figs. Price 148s., \$18.50.

Reviewed by L. S. Ramsdell in A.M. **46**-461.

R. A. H.

HOLDEN (A.) & SINGER (P.). *Crystals and crystal growing*. London (Heinemann), 1961, 320 pp. Price 10s. 6d.

R. A. H.

RHODES (P. S.). *The Antrim coast road : with notes and sketches of its geology and scenery*. Belfast (Northern Ireland Tourist Board), 1959, 39 pp., 33 figs. Price 2s.

R. A. H.

THOMAS (T. M.). *The mineral wealth of Wales and its exploitation*. Edinburgh (Oliver & Boyd), 1961, xv + 248 pp., 13 pls., 47 maps. Price £1 10s.

R. A. H.

TURNER (FRANCIS J.) & VERHOOGEN (JEAN). *Igneous and metamorphic geology*. 2nd edition. New York (McGraw-Hill Book Co.), 1960, 672 pp., 117 figs. Price \$12.00.

Reviewed by E. Wm. Heinrich in A.M. 45-473.

R. E. W.

WAHLSTROM (E. E.). *Optical crystallography*. 3rd edition. New York & London (John Wiley), 1960, 356 pp., 260 figs. Price \$8.50, 68s.

Reviewed by J. Shappirio in A.M. 46-240. R. E. W.

[IVANOV (A. A.) & LEVITSKIĬ (YU. F.)] Иванов (А. А.), и Левицкий (Ю. Ф.). Геология галогенных отложений (формаций) СССР [*The geology of halogenic deposits (formations) of the U.S.S.R.*]. Тр. ВСЕГЕИ [Trans. All-Union Res. Geol. Inst.], 1960, 35, 244 pp., 65 figs., 7 separate sheets of maps and sections. Price 31r. 35k.

The bulk of this work is written by Ivanov, while Levitsky is responsible for the Tertiary deposits of the Caucasus and Transcarpathian regions and for collaboration with Ivanov on the S.E. part of central Asia. The book provides a most detailed description of the halogenic formations (evaporite deposits) of the Soviet Union. It is based on first hand observations by the author and on extensive literature (listed in the bibliography pp. 403-422). All the rocks of these formations (salt, gypsum, anhydrite, marls, limestone, and others) are equally fully described. Description of the saliferous formations is done by systems; Cambrian (pp. 7-54), Ordovician and Silurian (pp. 55-59), Devonian (pp. 60-116), Carboniferous (pp. 117-127), Permian (pp. 128-270), Jurassic (pp. 241-273), Cretaceous (pp. 274-297), Tertiary (pp. 298-375); when needed, further age division and territorial sub-division is made. For each system the section ends with a summary reviewing territorial distribution, nature of deposits, principal features, conditions of formation, and economic factors. Particular emphasis is made on the palaeogeographic, climatic, and tectonic factors influencing the formation of saline deposits. Towards the end of the book (pp. 376-402) the saliferous formations of the U.S.S.R. are tabulated and their space, time, and facies relationships, partly based on the four types of association of marine beds, red beds, and

evaporites as devised by W. C. Krumbein (Journ. Sedim. Petr., 1951, 21, 63-81). Rock-types found among evaporites and their economic prospects are also discussed. The book provides a very useful summary of evaporite occurrences in the Soviet Union.

S. I. T.

[SHASKOL'SKAYA (M. P.)] Шаскольская (М. П.). Кристаллы [Crystals]. Гос. Изд. Тех.-Теор. Лит. [State Publ. Tech.-Theor. Lit.], Moscow, 1956, 228 pp., 178 figs. Price 6r. 60k.

CHASKOLSKAIA (M.). *Les cristaux*. Edit. Langues Étrang., Moscou, 1959, 290 pp., 178 figs. [Price not given.]

The Russian original and the French translation [note the French spelling of the authoress's name] form an interesting and popular introduction to the study of crystals in nature and in the laboratory. The chapters are: 1, We live in a world of crystals. 2, Crystals in nature. 3, Crystals in the laboratory and in the factory. 4, Properties of crystals. 5, Structure of crystals. 6, Crystals in the service of man. The book covers a very extensive field of study, such as the growth of crystals, paragenesis and geochemistry of minerals, artificial crystals, precious stones, physical and chemical properties of minerals, X-rays and the structure of crystals. Reference is made to historical aspects of crystallography and mineralogy. There are only a few minor errors—in caption to Fig. 135 (p. 172) read 'rhombic dodecahedron' instead of 'octahedron', p. 177, cubic system is characterised by four triad axes, p. 209, the 'Regent' diamond was found in India in 1701, not in South Africa. The book is profusely illustrated by well-chosen and well-reproduced photos and drawings. The two editions, in conjunction, may help the reader's Russian and French.

S. I. T.

[VLASOV (K. A.), KUZ'MENKO (M. V.), & ES'KOVA (E. M.)] Власов (К. А.), Кузьменко (М. В.) и Еськова (Е. М.). Ловозерский щелочной массив (породы, пегматиты, минералогия, геохимия и генезис) [*Lovozero alkaline massif (rocks, pegmatites, mineralogy, geochemistry, and genesis)*]. Изд. Акад. Наук СССР. [Publ. Acad. Sci. U.S.S.R.], 1959, 623 pp., 255 figs. Price 38r. 25k.

This is a monumental volume containing a very full account of the well-known Lovozero alkaline massif of the Kola peninsula, famous for its alkaline pegmatites containing abundant rare minerals. According to the latest data, the age of this massif is 266 m.y., that is, of Upper Devonian-Lower Carboniferous age. In part I (pp. 9-74) the geological structure and the petrology are discussed. The massif is a layered complex characterized right through by strong banding combined with a linear and planar flow texture of all the constituent minerals. The bands dip 5°-10° towards the centre of the intrusion. The upper

division, remnants of which are up to 500 metres thick, is made of indistinctly individualized bands, mainly of eudialyte-, aegirine-, and hornblende-lujavrite, together with urtite, foyaite, and juvite. The lower division, up to 1000 metres thick, is called 'differentiation complex' because the bands are much more individualized and distinct. This complex is formed mainly by the repetition of the triad, foyaite-urtite-lujavrite, in this order from top to bottom. The upper and the lower complexes are cut by the comparatively sparse complex of the so-called 'nepheline-, sodalite-, and hydrosodalite poikilitic syenites', relatively coarse rocks frequently passing into pegmatites.

In part II (pp. 77-238), pegmatites belonging to all the three complexes are described and discussed. They are classified as 'pure-line' pegmatites, and 'cross-line' or hybrid pegmatites. These are again classified according to their principal minerals, structure and texture, and genetic stage. The pegmatites are minutely described, and their genesis is discussed on the background of the four magmatic phases, magmatic-fluidal, fluidal-gaseous, fluidal-hydrothermal, and hydrothermal.

In part III (pp. 241-508) the minerals of the rocks and those of the pegmatites are minutely described. This description involves 200 full chemical analyses, 250 qualitative spectrographic analyses, over 70 X-ray and numerous thermal analyses, with crystallography, and optics. Altogether 130 minerals have been recorded in the Lovozero massif and of these 120 are described in the present volume. A number of these minerals are found only in this locality and some of them in only very small quantities in other localities. Sixty of these minerals contain rare elements (Zr, Nb, Th, Li, Be, and the rare-earths). The minerals are arranged in groups, such as: principal rock-forming minerals; rare-metals minerals such as zirconium-, niobium-, and titanium-containing minerals; and also minerals containing thorium, lithium and beryllium, and so on. Quite a number are minerals which have recently been described

and named, such as lovozerite, seidozerite, loparite, lomonosovite, murmanite, nenadkevichite, labuntsovite, kupletskite, vinogradovite, belyankinite, gerasimovskite, belovite, karpinskite, and others. *Hydrocerite* is described for the first time [M.A. 15-212].

In part IV (pp. 511-610) the geochemistry and genesis of the magmatic complex in general and of all the minerals in particular are discussed. First the chemical composition of the rocks forming the intrusive complex is studied; a very detailed discussion of the geochemistry of sixty-seven chemical elements follows, and finally the genesis of the massif is outlined. The factors which are considered to bear upon the problems of the genetic history, formation of rock facies, and distribution of the minerals and the chemical elements are: (1) chemical composition of the primary magma, (2) processes of assimilation of country rocks, (3) emanational processes leading to the migration of volatiles in the magma, (4) crystallization-differentiation leading to the banded distribution of the principal rock-forming minerals, with a rhythmic band formation from above downwards, (5) factors of isomorphous replacement during the hydrothermal phase. A bibliography is provided (pp. 611-618).

S. I. T.

[ZHEMCHUZHNIKOV (YU. A.) & GINZBURG (A. I.) Жемчужников (Ю. А.) и Гинзбург (А. И.). Основы петрологии углей [*Principles of the petrology of coals*]. Изд. Акад. Наук СССР. [Publ. Acad. Sci. U.S.S.R.], 1960, 337 pp., 79 figs. 62 pls. Price 25r. 30k.

This is a fundamental textbook on coals. The subjects discussed are: organic microcomponents of coals, physical and chemical composition of coals, genetic classification of coals, humic, liptobiotic and sapropelic coals, coalification, weathering of coals, nomenclature of coal types and macerals. The bibliography of works published in the Russian language occupies nineteen pages and the illustrations are very numerous.

S. I. T.

CLAY MINERALS

General : techniques : structure : properties

FRANK-KAMENETSKY (V. A.). *A crystallochemical classification of simple and interstratified clay minerals*. Clay Min. Bull., 1960, 4, 161-172.

An earlier classification scheme for clay minerals [V. A. FRANK-KAMENETSKY, *Issledovanie i ispolzovanie glin* (Ed. D. P. Bobrovnik et al.), 1958, Izdatelstvo Lvov Univ., p. 713] is revised and extended. The principal criteria for classification are the character of the octahedral population (dioctahedral, trioctahedral, intermediate) and the nature of the interlayer bonding (hydrogen bonding, intermolecular, ionic). Interstratified minerals are classified separately.

J. M. H.

GREENE-KELLY (R.) & WEIR (A. H.). *A silica spiral thermo-balance for studies on the dehydration of clay minerals*. Clay Min. Bull., 1956, 3, 68-78, 6 figs.

Results obtained with a new silica spiral thermo-balance are compared with d.t.a. curves of kaolinite and halloysite and dehydration curves of montmorillonite and bentonite. Constructional details and operational techniques of the balance are described.

R. A. H.

FAIRBAIRN (P. E.) & ROBERTSON (R. H. S.). *Liquid limit and dye adsorption*. Clay Min. Bull., 1957, 3, 129-136, 8 figs.

Cation exchange capacity as determined by methylene blue can be used by itself as a useful soil mechanical test, and could be used in conjunction with only a few full liquid limit tests where a problem involves variation in clays of the same general type.

R. A. H.

GREENE-KELLY (R.) & GALLAVAN (R. C.). *A micro-calorimeter for clay mineral studies*. Clay Min. Bull., 1957, **3**, 170–176, 1 fig.

The features required in a calorimeter for studying clay mineral systems are discussed and a calorimeter of high sensitivity is described in detail.

R. A. H.

McLAUGHLIN (R. J. W.). *Differential thermal analysis of kaolinite-illite mixtures*. Trans. Brit. Ceram. Soc., 1960, **59**, 178–187.

Variable effects on the illite 850°C peak arise from the degree of intimacy of mixing, concentration of illite on the kaolinite 500° endothermic peak, and products of reaction between sample, nickel sheath, and thermocouple, thus making d.t.a. a very unreliable quantitative method.

R. A. H.

TSUZUKI (YOSHIRO) & NAGASAWA (KEINOSUKE). *Differential thermal analysis curves for clay minerals as related to the kinetics of their dehydration*. Journ. Earth Sci. Nagoya Univ., 1957, **5**, 153–182, 15 figs.

Measurements of the velocity of decomposition of sixteen clay mineral specimens and of two carbonate specimens were made with a thermobalance, and from them the order of the reaction, energy of activation, and frequency factor are calculated, assuming that kinetic formulae for a homogeneous system can be applied to the decomposition reactions. The d.t.a. curves are discussed in terms of these kinetic constants. Temperature distribution in a sample undergoing d.t.a. is calculated and the shape of the d.t.a. curve discussed, taking into consideration the results of this calculation.

A. P.

BRINDLEY (G. W.) & NAKAHIRA (M.). *The role of water in the dehydroxylation of clay minerals*. Clay Min. Bull., 1957, **3**, 114–119, 3 figs.

Isothermal kinetic studies of dehydroxylation using kaolinite discs show that the attainment of a stationary state is dependent on the operating temperature. The rate of dehydroxylation is a function of specimen size and shape, suggesting a controlling influence by entrapped water vapour.

R. A. H.

MITRA (S. P.) & PRAKASH (DHARAM). *Adsorption of potassium as influenced by concentration and pH of the solution*. Clay Min. Bull., 1957, **3**, 151–153.

In experimental studies montmorillonite shows the greatest adsorption at all pH values. The adsorption varies with the concentration of K in solution, pH of solution, and the nature of the cations in the exchange complex. Data are given for kaolinite, montmorillonite, halloysite, and natrolite.

R. A. H.

WALKER (G. F.). *On the differentiation of vermiculites and smectites in clays*. Clay Min. Bull., 1957, **3**, 154–163, 1 fig.

The criteria used with clays for distinguishing vermiculites from smectites are critically examined. Inherent difficulties are heightened by the common occurrence of interlayer contamination in the naturally occurring minerals. Such structures may be justifiably characterized as vermiculitic or smectitic only if the swelling behaviour is not affected by the contaminant or if the contaminant can be removed without harming the silicate layers. Further research is needed.

R. A. H.

YOUELL (R. F.). *An electrolytic method for producing chlorite-like substances from montmorillonite*. Clay Min. Bull., 1960, **4**, 191–195.

Electrolytic deposition of $\text{Mg}(\text{OH})_2$ between unit layers of montmorillonite to give a pseudo-chlorite is more successful than direct chemical precipitation. Up to five brucite layers can be accommodated between the montmorillonite sheets. Ions other than magnesium may also be used.

J. M. H.

OBERLIN (AGNES) & TCHOUBAR (CYRIL). *Étude en microscopie et microdiffraction électroniques de l'altération des cristaux de la kaolinite par une solution acide*. C.R. Acad. Sci., Paris, 1960, **250**, 728–729.

Alteration of kaolinite by a solution at pH 2, the lowest value observed in nature, has demonstrated the formation of fireclay, the presence of which was proved by electron diffraction. The two minerals are always aligned along the a direction.

E. J. & A. S.

GIROD (JEAN) & LACROIX (JEAN). *Influence de l'acidité sur les mouvements de l'aluminium dans un mélange d'argiles*. C.R. Acad. Sci., Paris, **250**, 4182–4183.

Action of dilute acid on a mixture of kaolinite and montmorillonite causes transfer of a part of the aluminium from the former to the latter where it becomes fixed in displaceable state.

E. J. & A. S.

ZVIAGIN [=ZVYAGIN] (B. B.) & SHAKHOVA (R. A.). *Electron diffraction study by reflection of powder samples of celadonite*. Soviet Physics: Crystallography, 1957, **2**, 173–175, 4 figs. Translated from Kristallografiya, 1957, **2**, no. 1, 181–183.

The features of an electron diffraction reflection pattern of celadonite are explained in terms of the orientation of crystallites in the aggregate examined. [See also MITRA (R. P.) & RAO (M. V. R. K.). *Basal reflection of electron waves by oriented aggregates of clay minerals*. *Naturwissenschaften*, 1955, **42**, no. 5, 119–120, and following abstract.]

A. P.

ZVIAGIN [=ZVYAGIN] (B. B.). *Determination of the structure of celadonite by electron diffraction*. *Soviet Physics: Crystallography*, 1957, **2**, 388–394, 7 figs. Translated from *Kristallografiya*, 1957, **2**, no. 3, 393–399.

Cell dimensions determined by electron diffraction are: a 5.20, b 9.00, c 10.25 kX, β 100.1°. The composition is given as $K_{0.8}(Mg_{0.7}Fe_{1.4})(Al_{0.4}Si_{3.6}O_{10})(OH)_2$. The structure of the M1 type and the 6-fold rings of tetrahedra within the silicate sheets are ditrigonal. Source of the material examined is not stated.

A. P.

ZVYAGIN (B. B.). *Electron-diffraction determination of the structure of kaolinite*. *Soviet Physics: Crystallography*, 1960, **5**, 32–42, 6 figs., 3 tables. Translated from *Kristallografiya*, 1960, **5**, no. 1, 40–50.

The structure of triclinic kaolinite has been re-examined by texture electron-diffraction photographs and projections of the structure onto the xOz and Oyz planes, confirming the principal features found by Brindley and Nakahira [M.M. **31**–781].

A. P.

DRITS (V. A.) & KASHAEV (A. A.). *An x-ray study of a single crystal of kaolinite*. *Soviet Physics: Crystallography*, 1960, **5**, 207–210, 4 figs., 3 tables. Translated from *Kristallografiya*, 1960, **5**, no. 2, 224–227.

A single crystal of kaolinite $0.2 \times 0.2 \times 0.01$ mm in size was examined by oscillation, rotation, and Laue X-ray photographs. The atomic coordinates found for this triclinic kaolinite differ only slightly from those obtained from electron-diffraction data [preceding abstract. It is not clear whether both studies were carried out on material from the same source].

A. P.

MARTIN VIVALDI (J. L.) & MACEWAN (D. M. C.). *Corrensite and swelling chlorite*. *Clay Min. Bull.*, 1960, **4**, 173–181, 1 fig.

Interstratified chlorite minerals are considered, and a more exact definition of corrensite as a 1:1 regular interstratification of chlorite and swelling chlorite is suggested.

J. M. H.

MIDGLEY (H. G.) & GROSS (K. A.). *Thermal reactions of smectites*. *Clay Min. Bull.*, 1956, **3**, 79–90, 2 figs.

The thermal dehydration of a series of smectites has been

investigated by X-ray methods. The rate of collapse of the layers is found to be governed by the type of exchangeable ion present. Fibrous saponite from a vein in gneiss, Church Cove, Lizard, Cornwall, dehydrates to talc and then to enstatite, the 5.2 Å fibre axis remaining constant throughout. Analysis of this saponite, by L. J. Larnier, gave SiO_2 42.92, Al_2O_3 5.99, Fe_2O_3 1.57, FeO 0.43, MnO 0.03, CaO 0.80, MgO 26.71, H_2O (1000°C) 21.81, [=100.26], H_2O — 13.72; it is green, H . 2, α 1.520, γ 1.535, $\gamma:z=11^\circ$; the fibres give a biaxial positive interference figure with small 2V.

R. A. H.

BRUYN (C. M. A. DE), COLLINS (L. E.), & WILLIAMS (A. A. B.). *The specific surface, water affinity, and potential expansiveness of clays*. *Clay Min. Bull.*, 1957, **3**, 120–128, 3 figs.

The mechanism by which water is absorbed by soils causing expansion, is discussed. The expansiveness is shown to depend on the presence of montmorillonitic and illitic clays. The investigation used a microdesiccator method of deriving water vapour pressure isotherms and the technique of glycol retention.

R. A. H.

Soil : weathering : applied

SAKAMOTO (TAKAO). *Zonal arrangement of residual clays*. *Journ. Fac. Sci. Tokyo Univ.*, 1954, **9**, 301–324, 1 fig.

A general discussion, mostly based on standard works, of the processes and mineralogical changes involved in the formation of residual clays.

A. P.

GJEMS (O.). *Some notes on clay minerals in podzol profiles in Fennoscandia*. *Clay Min. Bull.*, 1960, **4**, 208–211, 1 fig.

X-ray diffraction shows montmorillonite to be a predominant clay mineral in the $< 2 \mu$ fraction of the A₂ horizon of podzol profiles in Fennoscandia, even when these are less than 300 years old. Although rarely detected above 20 μ , vermiculite and hydrobiotite predominate in the 2–20 μ fractions and are also found in the finer fractions of the B horizon. Their rare occurrence in the C horizon, and also the occasional presence of kaolinite in some profiles, is attributed to contamination with interglacial or older products of weathering.

J. M. H.

MITCHELL (B. D.) & MITCHELL (W. A.). *The clay mineralogy of Ayrshire soils and their parent rocks*. *Clay Min. Bull.*, 1956, **3**, 91–97, 2 figs.

The clay mineralogy of soils developed on boulder clay derived from igneous and sedimentary rocks is compared with that of the parent rock; a definite relationship is shown to exist, particularly definite for the sediments. The influence of pedogenic processes on the clay mineral distributions in the soil profiles is discussed.

R. A. H.

PROUDFOOT (V. B.). *Relict Rotlehm in Northern Ireland*. Nature, 1958, **181**, 1287.

The development, by weathering of granodiorite, of a Rotlehm soil is discussed. C. H. K.

NICHOLLS (G. D.) & LORING (D. H.). *Some chemical data on British Carboniferous sediments and their relationship to the clay mineralogy of these rocks*. Clay Min. Bull., 1960, **4**, 196–207, 1 fig.

Analyses of shales, mudstones, and associated strata from the British Coal Measures reflect their general similarity in respect of clay mineralogy. Variation in the Na^+/K^+ ratio appears due to variation of this ratio in illite. It is suggested that post-depositional changes have caused the Na^+/K^+ ratio to fall. Such changes tend to be inhibited under conditions of rapid sedimentation, but to continue to an advanced stage in the slowly deposited seat-earth, giving a low Na^+/K^+ ratio in the final sedimentary rock.

J. M. H.

SMITH (W. W.). *Some interstratified clay minerals from basic igneous rocks*. Clay Min. Bull., 1960, **4**, 182–190, 1 fig.

Two-component interstratified minerals (consisting mainly of various combinations of chlorite, swelling chlorite, and saponite) are present in two basalts from Holyrood Park, Edinburgh [M.M. 32–324], and in a dolerite from Hume Craigs, Kelso. X-ray diffraction and d.t.a. data are given.

J. M. H.

FREEMAN (I. L.). *Variation in the lower zones of the Oxford Clay*. Clay Min. Bull., 1956, **3**, 50–61, 8 figs.

Vertical variation in two brick pits in the Oxford Clay of the English Upper Jurassic has been proved by d.t.a. and differential thermogravimetry techniques and by acid-soluble CaO determinations. The lowest beds are high in organic matter and low in acid-soluble CaO, whereas this trend is reversed higher up the succession. Illite is the dominant clay mineral. The ignition range and other characteristics of the organic material resemble those of lignite.

R. A. H.

PETERS (T.). *Tonmineralogische Untersuchungen an Glazialmergeln von Zolllikofen und an den aquitanen Tonen und Mergeln von Pieterlen*. Schweiz. Min. Petr. Mitt., 1961, **41**, 71–84, 4 figs.

Specimens of clay from glacial deposits and from molasse near Berne are investigated. The most important difference is the presence of montmorillonitic minerals in the molasse clays.

M. W.

GRIM (R. E.) & VERNET (J. P.). *Étude par diffraction des minéraux argileux de vases méditerranéennes*. Schweiz. Min. Petr. Mitt., 1961, **41**, 65–70, 2 figs.

Samples obtained from the sea bottom in the vicinity of the islands of Capri and Sardinia show the following mineral composition of their clay fraction: illite, chlorite, kaolinite, and montmorillonite of volcanic origin.

M. W.

GONZALEZ GARCIA (F.), PEYRO CALLIZO (A.), & GONZALEZ GARCIA (S.). *Mineralogical composition and properties of sedimentary clays from Lebrija (Spain)*. Clay Min. Bull., 1956, **3**, 62–67, 2 figs.

The Pliocene clays of Lebrija, near Seville, known for their decolorizing properties, are shown by chemical, dehydration, d.t.a., X-ray, and electron microscope methods to consist of approximately equal quantities of palygorskite and illite. [M.A. 14–391]

R. A. H.

NEVES (J. M. CORREIA). *Montmorillonite da Quitota (Angola)*. Mem. & Not., Publ. Mus. Lab. Min. Geol., Univ. Coimbra, 1958, **45**, 10–13, 2 figs., 1 pl., 2 tables, (summaries in English and French).

A soft, brown mineral from Quitota, uniaxial, -ive, refr. ind. slightly <1.527 , was identified as calcic montmorillonite. Indexed X-ray data are listed, and d.t.a. results figured.

J. Ph.

SUDO (TOSHIO). *Types of clay minerals closely associated with metalliferous ores of the epithermal type*. Sci. Rept., Tokyo Univ. of Education, section C, 1954, **3**, 173–197, 12 figs., 2 pls., 8 tables.

Two chemical analyses of sericite, one of thuringite, and two of chamosite are reported, together with analyses of several 'clays'. X-ray and d.t.a. data are given for most of the analysed materials. Kaolin minerals and montmorillonite are found with Au and Ag ores, sericite frequently with Te, Ag, Au, Hg, Sb, and Cu ores, whereas sericite and chlorite are usually the dominant alteration products intimately associated with Pb, Zn, and Cu ores. Magnesian chlorite, leuchtenbergite (analysis given), is associated with gypsum deposits. The associations in 17 epithermal ore deposits of Japan are summarized in a table.

A. P.

SUDO (TOSHIO) & HAYASHI (HISATO). *New types of clay minerals with long spacings at about 30\AA found from the altered area developed around certain ore bodies of the Hanaoka mine, Akita Prefecture*. Sci. Rept., Tokyo Univ. of Education, section C, 1955, **3**, 281–316, 11 figs., 1 pl., 7 tables.

Spacings of 29.6 and 26.6\AA were found in clay minerals associated with Pb-Zn ore and gypsum respectively. The 29.6\AA spacing is attributed to regular interstratification between montmorillonite (15.4\AA) and a 'new lattice' (14.0\AA) itself considered to be a regular interstratification between

gibbsite and pyrophyllite. The 26.6Å spacing is considered due to regular interstratification between sepiolite (12.7Å) and chlorite (14.5Å). A. P.

SUDO (TOSHIO). *X-ray and thermal data for clay minerals formed by the alteration of volcanic materials*. Sci. Rept., Tokyo Univ. of Education, section C, 1956, **5**, 39–55, 3 figs., 3 pls., 3 tables.

Altered volcanic glass fragments from many localities in Japan were examined by thermal and X-ray methods. Two principal kinds of alteration product can be distinguished, an allophane-hydrated halloysite association and montmorillonite associated with a 7Å kaolin mineral. Numerous d.t.a. curves and X-ray powder diffraction patterns are reported and six electron micrographs are reproduced.

A. P.

SUWA (KANENORI), MATSUZAWA (ISAO), IIDA (CHUZO), & YAMASAKI (KAZUO). *Mineralogical and geochemical studies on the weathering of a quartz porphyry*. Journ. Earth Sci., Nagoya Univ., 1958, **6**, 75–100, 5 figs., 1 pl., 11 tables.

Quartz porphyry from Kôjin-yama, Shiga Prefecture, central Japan, and its weathering products were investigated, using microscopic, X-ray, d.t.a., chemical, and spectrographic methods. Quartz, zircon, and epidote are resistant to chemical attack on weathering; orthoclase and orthoclase perthite are fairly resistant, and oligoclase less resistant. Hydrated halloysite and illite occur in minor amount in the partly weathered rock and in considerable quantities in the completely weathered rock. Goethite and chlorite occur in the partly weathered rock but are absent in the completely weathered rock. The changes in con-

centration of all of the major elements and many of the minor elements in the rock are recorded. A. P.

BRINDLEY (G. W.). *Fuller's earth from near Dry Branch, Georgia, a montmorillonite-cristobalite clay*. Clay Min. Bull., 1957, **3**, 167–169, 1 fig.

Tertiary fuller's earth from near Dry Branch contains comparable amounts of lath-like montmorillonite and globular cristobalite and only minor amounts of other minerals. The X-ray powder reflections of the cristobalite indicate it to be a high-temperature cristobalite or possibly a very disordered low-temperature form. R. A. H.

MARTIN (R. T.) & LAMBE (T. W.). *Soil composition and its influence on the engineering behaviour of fine-grained soils*. Clay Min. Bull., 1957, **3**, 137–150, 6 figs.

Most of the soils studied which had caused instability on volume changes in the field were found to contain expansive minerals. The clay in 50% of the soils examined was an illite-smectite type, and an illite-chlorite in 15%. The most important influence of composition on behaviour is the very high water sensitivity of the expansive minerals.

R. A. H.

NORRISH (K.) & RADOSLOVICH (E. W.). *Effect of biotite on the firing characteristics of certain weathered schists*. Clay Min. Bull., 1957, **3**, 189–192.

A study of clays used for brick-making, including 5 chemical analyses, showed that those clays which crumbled on firing contained partially weathered biotite which exfoliated and disrupted the bricks at a comparatively low temperature. Fresh biotite and highly weathered biotite do not have this adverse effect.

R. A. H.

CRYSTAL STRUCTURE OF MINERALS

General

MOOSER (E.) & PEARSON (W. B.). *The ionic character of chemical bonds*. Nature, 1961, **190**, 406–408.

The terms 'effective' and 'formal' bond ionicity are discussed [M.A. 15–19], with particular reference to blends. M. J. Le B.

BELOV (N. V.). [One-dimensional infinite crystallographic groups]. Kristallografiya, 1956, **1**(4), 474–476, 2 figs., (in Russian).

The 31 two-sided band groups, discussed by Shubnikov [M.A. 4–298] are pictured and given a modern symbolism. They may also be considered one-sided but two-coloured. Alternative sets of symbols are given for the two points of view.

A. P.

ZAMORZAEV (A. M.) & SOKOLOV (E. I.). *Symmetry and various kinds of antisymmetry of finite bodies*. Soviet Physics: Crystallography, 1957, **2**, 5–9. Translated from Kristallografiya, 1957, **2**(1), 9–14.

Shubnikov antisymmetry can be generalized to a different kind of antisymmetry by assigning not one, but two, three, or more signs of different meanings to the points of a body. [See following abstract]

A. P.

ZAMORZAEV (A. M.). *Derivation of new Shubnikov groups*. Soviet Physics: Crystallography, 1958, **3**, 401–406. Translated from Kristallografiya, 1958, **3**(4), 399–404.

The concept of antisymmetry of different kinds is applied to translation groups. A complete derivation of generalized space translation and antitranslation groups is

given, the results of a complete calculation of the generalized Shubnikov groups for the case of two signs are summarized very briefly, and the prospects for further investigation are indicated. [See preceding abstract and MACKAY (A. L.). *Extensions of space group theory*. Acta Cryst., 1957, **10**, 543-548] A. P.

ZAMORZAEV (A. M.) & PALISTRANT (A. F.). *The two-dimensional Shubnikov groups*. Soviet Physics: Crystallography, 1961, **5**, 497-503. Translated from Kristallografiya, 1960, **5**(4), 517-524.

The assignment to points of the plane of the signs + or - in several different senses produces further generalization of the known 17 Fedorov and 80 Shubnikov (Cochran) groups. All the possibilities of nontrivial generalizations were investigated, and the number of essentially new groups completely counted. A. P.

BELOV (N. V.). *Concerning the tetrahedral ($T=23$) and gyrohedral ($O=432$) groups*. Soviet Physics: Crystallography, 1957, **2**, 712-714, 3 figs. Translated from Kristallografiya, 1957, **2**(6), 722-724.

Consecutive rotations around two triad axes with an included angle of $109^{\circ}28'16''$ will be equivalent to rotation about one of the coordinate diad axes if the triad rotations are opposite in sign, but equivalent to rotation on a triad axis if both rotations have the same sign. A. P.

BELOV (N. V.). *A theorem on the primitiveness (emptiness) of the unit cell of a crystal*. Soviet Physics: Crystallography, 1957, **2**, 715-717, 2 figs. Translated from Kristallografiya, 1957, **2**(6), 725-727.

A simplified proof is given that the cell defined by the three shortest noncoplanar translations in the lattice must be primitive. A. P.

CHELUDEV (I. S.). *The point groups of symmetry of crystals and their physical interpretation*. Soviet Physics: Crystallography, 1957, **2**, 718-722, 6 figs. Translated from Kristallografiya, 1957, **2**(6), 728-733.

It is shown that the 32 crystallographic point groups can be obtained by means of scalar, vector, and tensor operations on a cube. The hypothesis is put forward that the differences in the properties of crystals having the same symmetry group correspond to the diverse ways in which these groups may be obtained. [Author's abstract] A. P.

SHUBNIKOV (A. V.). *Antisymmetry of textures*. Soviet Physics: Crystallography, 1958, **3**, 269-273, 4 figs. Translated from Kristallografiya, 1958, **3**(3), 263-268.

The antisymmetry of textures with infinity-fold symmetry axes can be described in terms of 13 limiting point groups. A. P.

BELOV (N. V.). *The hexagonal space groups*. Soviet Physics: Crystallography, 1960, **4**, 251-258, 12 figs. Translated from Kristallografiya, 1959, **4**(2), 268-276.

Notes on the derivation of the hexagonal space groups and on features of a few of the representative crystal structures (wurtzite, molybdenite, pyrrhotine, apatite, benitoite, diopside, corundum, and calcite). A. P.

SHUBNIKOV (A. V.). *Complete systematics or point groups of symmetry*. Soviet Physics: Crystallography, 1960, **4**, 267-269. Translated from Kristallografiya, 1959, **4**(3), 286-288.

A scheme for tabulating all three-dimensional point groups, crystallographic and noncrystallographic, is presented. A. P.

BELOV (N. V.) & BELOVA (E. N.). *Mosaics for 46 plane (Shubnikov) antisymmetry groups and for 15 (Fedorov) color groups*. Soviet Physics: Crystallography, 1957, **2**, 16-18. Translated from Kristallografiya, 1957, **2**(1), 21-22. (Colour plate in original is reproduced in half-tone with the translation.)

Mosaics for the 46 (Cochran) groups are shown in black and white, those for the 15 (Fedorov) colour groups in colours, a maximum of six colours being required for some. Alternative designs are shown for some of these. [See following abstract] A. P.

— — & TARKHOVA (T. N.). *More about the colour symmetry groups*. Soviet Physics: Crystallography, 1959, **3**, 625-626, 18 figs. Translated from Kristallografiya, 1958, **3**(5), 618-620.

Alternative patterns with numbered instead of coloured polygons are presented to illustrate some of the 15 (Fedorov) colour groups. [See also BELOV (N. V.) & TARKHOVA (T. N.). *Groups of color symmetry*. Kristallografiya, 1956, **1**(1), 4-13, 8 figs., 1 colour pl.] A. P.

BELOV (N. V.) & KLEVTSOVA (R. F.). *The simplest method of deriving the Fedorov (space) groups*. Soviet Physics: Crystallography, 1960, **4**, 270-273. Translated from Kristallografiya, 1959, **4**(3), 289-292.

— — *A very simple way of deducing the space groups*. Soviet Physics: Crystallography, 1960, **4**, 448-451, 4 figs. Translated from Kristallografiya, 1959, **4**(4), 473-476.

The methods depend upon manipulation of Hermann-Mauguin type symbols. Examples in the earlier paper are

from the orthorhombic system only. In the second, examples are taken from the tetragonal system as well.

A. P.

HOLSER (W. T.). *Relation of symmetry to structure in twinning*. Zeits. Krist., 1958, **110**, 249-265, 3 figs., 2 tables.

The possible symmetries of the boundary structures of twins are those of the 80 two-sided plane groups. [See following abstract]

A. P.

HOLSER (W. T.). *Point groups and plane groups in a two-sided plane and their subgroups*. Zeits. Krist., 1958, **110**, 266-281, 4 tables.

The point groups and plane groups of a two-sided plane are relisted in Hermann-Mauguin notation, and their general subgroups are derived. The new notation is correlated with that of Alexander and Herrmann [M.A. 4-155]. [See following abstract]

A. P.

BELOV (N. V.). *On the nomenclature of the 80 plane groups in three dimensions*. Soviet Physics : Crystallography, 1960, **4**, 730-733. Translated from Kristallografiya, 1959, **4**(5), 775-778.

Four types of symbols are correlated, 'rational symbols', 'Cochran symbols' [Acta Cryst. 1952, **5**, 630-633], 'Initial Fedorov group with inverting elements of symmetry', and 'Initial Fedorov group arranging connected objects on two levels'. [See preceding abstract]

A. P.

ZAMORZAEV (A. M.). *Generalization of Fedorov groups*. Soviet Physics : Crystallography, 1957, **2**, 10-15. Translated from Kristallografiya, 1957, **2**(1), 15-20.

A method for deriving the Shubnikov or black-white space groups is outlined. [See following abstract]

A. P.

BELOV (N. V.), NERONOVA (N. N.), & SMIRNOVA (T. S.). *Shubnikov groups*. Soviet Physics : Crystallography, 1957, **2**, 311-322. Translated from Kristallografiya, 1957, **2**(3), 315-325.

The 1651 Shubnikov groups are represented in the international notation, tabulated by systems and correlated with the Fedorov groups. This is preceded by statement of a few fundamental theorems and by figures showing the 22 bicoloured lattices together with the 14 Bravais lattices. [See preceding and following abstracts]

A. P.

DONNAY (GABRIELLE), BELOV (N. V.), NERONOVA (N. N.), & SMIRNOVA (T. S.). *The Shubnikov groups*. Soviet Physics : Crystallography, 1959, **3**, 642-644. Translated from Kristallografiya, 1958, **3**(5), 635-636.

Reply to an inquiry concerning errors in an earlier listing of the Shubnikov groups in Trudy Inst. Krist., 1955, **11**, 33-67. [See preceding abstract]

A. P.

SHUBNIKOV (A. V.). *Symmetry and antisymmetry of rods and semicontinua with principal axis of infinite order and finite transfers along it*. Soviet Physics : Crystallography, 1960, **4**, 261-266, 3 figs. Translated from Kristallografiya, 1959, **4**(3), 279-285.

There are 25 bicoloured rod groups with principal axis of infinite order. Seven correspond to the seven simple band groups, seven are the corresponding 'grey' groups, and eleven are 'black and white'.

A. P.

SILABEE (R. H.). *Electron spin resonance in neutron irradiated quartz*. Journ. Appl. Phys., 1961, **32**, 1459-1462.

The electron spin resonance of one of the defects produced by fast neutron irradiation of crystalline quartz was analyzed. The 'g' tensor and hyperfine tensors deduced from these results imply that the defect electron is in a nonbonding tetrahedral hybrid orbital on a silicon atom. It is suggested that the instability of the lattice at high doses results in part from the presence of these defects.

R. G. Wls.

BELOV (N. V.). *Problems in the crystal chemistry of the silicates*. Soviet Physics : Crystallography, 1960, **4**, 10-13. Translated from Kristallografiya, 1960, **5**(1), 15-18.

Brief historical comments with emphasis on some of the less familiar structure types and on recent trends in the Soviet Union.

A. P.

Structure of minerals

MEIER (W. M.). *A new way of representing silicate frameworks*. Zeits. Krist., 1960, **114**, 478-480, 2 figs.

Useful models of aluminosilicate structures can be readily made by connecting tetrahedral units, made of ball and pegs, with short pieces of rubber-tubing.

R. A. H.

ZOLTAI (TIBOR). *Classification of silicates and other minerals with tetrahedral structures*. Amer. Min., 1960, **45**, 960-973, 3 tables.

The average number of tetrahedra to which the anion of a tetrahedral structure belong is defined as the 'sharing coefficient'. Its relation to structure types and cation-anion ratios is set forth in a table. Examples of the types and subtypes of tetrahedral structures, mostly silicates, are listed and the sharing coefficients given for each example together with a statement of the number of tetrahedra

involved in repeat units or loops. An expression is derived for determining sharing coefficients from structural formulas.

A. P.

BELOV (N. V.). *New silicate structures*. Soviet Physics: Crystallography, 1957, **2**, 361–365, 4 figs. Translated from Kristallografiya, 1957, **2**(3), 366–370.

A short review of about 10 such structures, all from the author's laboratory, which form a substantial addition to the classical system of silicates by W. L. Bragg.

A. P.

SIMONOV (V. I.). *Baotite—a mineral with $(\text{Si}_4\text{O}_{12})$ meta-silicate rings*. Soviet Physics: Crystallography, 1961, **5**, 523–525, 1 fig. Translated from Kristallografiya, 1960, **5**(4), 544–546.

The crystal structure of baotite [M.A. 15–135] was established by the method of minimalization of Patterson projections. The final atomic coordinates resulted from several computations of signs of hkl alternating with Fourier synthesis. Baotite is a new example of a ring silicate with tetragonal radicals $(\text{Si}_4\text{O}_{12})$ which are on the 4-fold inversion axes; (Ti, Nb) -octahedra are around the 4-fold screw axes in columns analogous to those in the structure of rutile. Only the x and y coordinates have been determined.

A. P.

SIMONOV (V. I.) & BELOV (N. V.). *The determination of the structure of seidozerite*. Soviet Physics: Crystallography, 1960, **4**, 146–157, 6 figs., 3 tables. Translated from Kristallografiya, 1959, **4**(2), 163–175.

The crystal structure of the Zr-Ti silicate seidozerite has been elucidated by superposition of the (x, z) Patterson projection and by statistical determination of the signs of the F_{0kl} reflections. From the structure the expanded chemical formula of seidozerite is given as $\text{Na}_4\text{MnTi}(\text{Zr}_{1.5}\text{Ti}_{0.5})\text{O}_2(\text{F}, \text{OH})_2(\text{Si}_2\text{O}_7)_2$ and its diorthosilicate nature (containing the group Si_2O_7) is revealed, despite the orthosilicate stoichiometric formula. An alternative unit cell, with shorter c , is obtained by the transformation 100/010/101, but the structure is described in terms of the previously reported [M.A. 14–198] cell. The space group is $P2/c$. [M.A. 14–178, 253]

A. P.

STRUNZ (H.) & GIGLIO (M.). *Die Kristallstruktur von Stottit $\text{Fe}[\text{Ge}(\text{OH})_6]$* . Acta Cryst., 1960, **14**, 205–208, 3 figs.

Stottite in pseudo-octahedral crystals from Tsumeb, S.-W. Africa [M.A. 14–281] has space group $C_{4h}^2-P4_2/n$, a 7.55, c 7.47 Å; cell content 4 $\text{FeGe}(\text{OH})_6$. Two-dimensional Patterson and Fourier studies show it to have Fe and Ge in symmetry centres, like Na and Cl in halite, and OH groups in general positions. The coordination polyhedra are

pseudo-octahedral $[\text{Fe}(\text{OH})_6]^{4-}$ and $[\text{Ge}(\text{OH})_6]^{2-}$ groups regularly alternating to form a three dimensional framework.

R. A. H.

COLLIGAN (G.) & GALASSO (F.). *Structure of vapour-deposited carbon*. Nature, 1961, **190**, 621–622, 1 fig.

The degree of order of pyrolytic graphite is controlled not only by temperature, but also by pressure, gas-flow, and method of heating the carbon-bearing gas phase [M.A. 15–19].

M. J. Le B.

KONDRASHEV (Iu. [= Yu.] D.). *The crystal structure and composition of crednerite, CuMnO_2* . Soviet Physics: Crystallography, 1960, **3**, 703–706, 2 figs. Translated from Kristallografiya, 1958, **3**(6), 696–699.

Cell dimensions of synthetic monoclinic CuMnO_2 are found to be a 5.530 ± 0.005, b 2.884 ± 0.002, c 5.898 ± 0.005 Å, β 104.6 ± 0.1°, very close to the dimensions reported for crednerite [M.A. 13–129]. The cell content is 2 formula units. A structure is found in the space group $C2/m$.

A. P.

AFANAS'YEVA (N. A.), KAMENTSEV (I. E.), & FRANK-KAMENETSKIĬ (V. A.). *Variation of the elementary parameters of quartz of different sources*. Soviet Physics: Crystallography, 1960, **4**, 354–357, 2 figs., 2 tables. Translated from Kristallografiya, 1959, **4**(3), 382–385.

Lattice parameters have been determined with an accuracy of ± 0.0002 Å for 10 specimens of natural quartz for which the source, paragenesis, and spectroscopically determined impurities are reported. a varies from 4.9121 to 4.9137 and c from 5.4031 to 5.4051 Å. Cell volumes are plotted against impurity content, showing only a rough correlation. [See following abstract]

A. P.

FRANK-KAMENETSKIĬ (V. A.). *Manifestation of microisomorphism in quartz*. Soviet Physics: Crystallography, 1961, **5**, 622–626, 4 figs. Translated from Kristallografiya, 1960, **5**(4), 650–654.

Precision X-ray data are presented for 10 natural and 35 synthetic quartz crystals differing in origin and composition. The lattice parameter variations are: a 4.9026–4.9038, c 5.3933–5.3945 kX (synthetic); a 4.9023–4.9039, c 5.3923–5.3944 kX (natural). Lattice parameters are compared with impurity contents. It is shown that impurities such as Al, Na, Fe, Mg, and Ge cause microisomorphous substitution in quartz. The unit cell becomes larger with increasing impurity content. Microisomorphous relations act on the growth and morphology of quartz and are also connected with the genetic and paragenetic conditions of natural quartz. [See preceding abstract. Presumably the 10 natural crystals are those there referred to. Note change in units from Å to kX]

A. P.

BELOV (N. V.). *The crystal structure of baddeleyite (monoclinic ZrO_2)*. Soviet Physics: Crystallography, 1960, **5**, 436–438, 3 figs. Translated from Kristallografiya, 1960, **5**(3), 460–461.

Description and discussion of the structure determined by McCullough and Trueblood [M.A. **14**–327]. A. P.

VORONOVA (A. A.) & VAINSHTEIN (B. K.). *An electron-diffraction study of $CuCl_2 \cdot 3Cu(OH)_2$* . Soviet Physics: Crystallography, 1958, **3**, 445–451, 7 figs., 4 tables. Translated from Kristallografiya, 1958, **3**(4), 444–451.

The metastable polymorph of atacamite and paratacamite crystallizes in the space group $P2_1/m$ with one formula unit in the cell of dimensions a 5.73, b 6.12, c 5.63 Å, β 93°45'. The structure has been fully determined.

A. P.

CHRIST (C. L.) & CLARK (J. R.). *The crystal structure of meyerhofferite, $CaB_3O_3(OH)_5 \cdot H_2O$* . Zeits. Krist., 1960, **114**, 321–342, 2 figs.

——— *Hauptman-Karle phase determination applied to meyerhofferite*. Ibid., 1960, **114**, 343–354; 1 fig.

Meyerhofferite is triclinic $P\bar{1}$, a 6.63, b 8.35, c 6.46, α 90°46', β 101°59', γ 86°55'; $Z=2$, D 2.120 g/cm³. A trial structure was established and has been refined by successive electron-density projections and least-squares analysis. Meyerhofferite contains the polyion $[B_3O_3(OH)_5]^{2-}$ consisting of two boron-oxygen tetrahedra and a boron-oxygen triangle linked at corners to form a ring. The insular polyions are linked together by calcium-oxygen bonds to form zig-zag strings along [001]; the strings and the water molecule are in turn linked by a network of hydrogen bonds. In the second paper the procedures used to calculate the signs of the structure factors are described in detail. [M.A. **7**–353, **12**–330, **14**–105]

R. A. H.

ILYUKHIN (V. V.) & BELOV (N. V.). *Derivation of the structure of lovozerite from sections of the three-dimensional Patterson function*. Soviet Physics: Crystallography, 1960, **5**, 186–198, 12 figs., 4 tables. Translated from Kristallografiya, 1960, **5**(2), 200–214.

Lovozerite is monoclinic, cell dimensions a 10.48, b 10.20, c 7.33 Å, β 92°30', cell content 2 formula units, $Na_2ZrSi_6O_{15} \cdot 3H_2O \cdot 0.5NaOH$. A structure has been deduced in the space group $C2$. The silicon-oxygen radical is shown to be a $(Si_6(O,OH)_{18})$ ring. Previously reported to be uniaxial, it is found that β is nearly the same as γ , 1.560, the Y and Z optic directions being close to the diagonals of (001) along which there are identical arrays of Zr and Na atoms. X is close to c with $\alpha=1.549$. [M.A. **7**–468]

A. P.

ELISEEV (E. N.). *New data on the crystal structure of olivine*. Soviet Physics: Crystallography, 1958, **3**, 163–170, 6 figs., 3 tables. Translated from Kristallografiya, 1958, **3**(2), 167–174.

Cell dimensions were determined on 12 specimens of olivine ranging from $Fe_{100}Fa_0$ to Fe_4Fa_{96} , the two most rich in Fe being from smelter slags. Compositions were determined from refractive indices. Dimensions do not vary in a linear fashion with molar composition; a and b show slight positive departures and c slight negative departure from linearity. The appearance of 'forbidden' reflections in the olivine patterns by secondary diffraction is discussed.

A. P.

MORIMOTO (NOBUO). *The existence of monoclinic pyroxenes with the space group $C_{2h}^5-P2_1/c$* . Proc. Japan Acad., 1956, **32**, 750–752, 2 figs.

Single crystal X-ray examination of an exsolution intergrowth of pigeonite ($Wo_{16}En_{45}Fs_{39}$) and augite ($Wo_{32}En_{37}Es_{31}$) described by Kuno [M.A. **6**–295] shows that b^* and c^* are coincident for the two phases but that the two a^* axes are at an angle of about 2° to each other. The cell dimensions and space groups are found to be:—pigeonite a 9.709, b 8.940, c 5.240 all ± 0.005 Å, β 71°30' \pm 20', $P2_1/c$; augite a 9.714, b 8.940, c 5.260 all ± 0.005 Å, β 73°48' \pm 20', $C2/c$.

A. P.

NEWNHAM (R. E.). *A refinement of the dickite structure and some remarks on polymorphism in kaolin minerals*. Min. Mag., 1961, **32**, 683–704, 10 figs.

The crystal structure of dickite from Pine Knot Colliery, Schuylkill County, Pennsylvania [M.A. **6**–137] has been refined to a greater accuracy than that reported earlier [M.A. **14**–25]. Improved parameters are a 5.150 \pm 0.001, b 8.940 \pm 0.001, c 14.424 \pm 0.002 Å, β 96°44' \pm 1'; d_{002} 7.162 \pm 0.001 Å. There are significant distortions from the geometry of the idealized kaolin layer, including deformation and rotation of the silica tetrahedra. The infrared spectrum shows medium absorption bands at 2.70 and 2.74 μ and a strong band at 2.765 μ . There are 36 ways of superimposing two kaolin layers commensurate with the O–OH bands found in kaolinite, dickite, and nacrite; 12 of these arrangements are to be preferred if the cation superposition of consecutive layers is to be minimized. These 12 sequences generate 2 one-layer unit cells (kaolinite and its mirror image) and 12 two-layer cells (including dickite and nacrite). The most stable configurations seem likely to be those of dickite and nacrite.

R. A. H.

BRINDLEY (G. W.) & NAKAHIRA (M.). *A new concept of the transformation sequence of kaolinite to mullite*. Nature, 1958, **181**, 1333–1334, 1 fig.

The transformation takes place through a defect silicon spinel structure and possibly a 1 : 1 mullite-type phase.

C. H. K.

ZVYAGIN (B. B.) & MISHCHENKO (K. S.). *Electron-diffraction refinement of the structure of muscovite*. Soviet Physics: Crystallography, 1961, **5**, 575–579, 3 figs. Translated from Kristallografiya, 1960, **5**(4), 600–604.

On the basis of electron-diffraction data from texture patterns a refinement of the structure of muscovite has been carried out with the use of Fourier syntheses. Al may replace Si only in half of the tetrahedra which are joined to the oxygens next to the glide planes of the octahedral layer. This substitution results mainly in a change in the oxygen position in the reflection plane of the tetrahedral layer, and, as a result, in a shift of K, and leads to a slight increase in β over the theoretical value. The muscovite examined is a $2M_1$ type. Its source and composition are not stated. [See also Radoslovich (E. W.), M.A. **15**–97] A. P.

ZEVIN (L. S.) & LEIZERSON (M. S.). *The problem of the position of the potassium ion in mica structure*. Soviet Physics: Crystallography, 1960, **4**, 395–396, 1 fig. Translated from Kristallografiya, 1959, **4**(3), 422–423.

Electron density projections on the c axis made from $00l$ diffraction data on two phlogopite crystals indicate that the potassium ions are situated midway between successive sheets. A. P.

DENT (L. S.) & SMITH (J. V.). *Crystal structure of chabazite, a molecular sieve*. Nature, 1958, **181**, 1794–1796, 2 figs.

Chabazite, $(Ca_{0.90}Na_{0.15})(Si_{4.05}Al_{1.95})O_{12} \cdot 6H_2O$, is trigonal with a 9.40 Å, α 94°18' and space group $R\bar{3}m$. The structure has double six-membered rings forming one 'cage' per unit cell. Refinement is being carried out on data from a specimen whose cavities are filled with water and calcium ions. More data are being collected from a dehydrated specimen held at 300°C, but little change in the structure is expected. The interatomic distances (Si, Al)–O and O–O range from 1.63–1.68 Å and 2.62–2.82 Å respectively. The structure accounts for the sorptive properties and explains chabazite-gmelinite intergrowths. C. H. K.

RUMANOVA (I. M.) & NIKOLAEVA (T. V.). *Crystal structure of orthite*. Soviet Physics: Crystallography, 1960, **4**, 789–795, 3 figs., 3 tables. Translated from Kristallografiya, 1959, **4**(6), 829–835.

The structure of orthite [allanite] found by Ueda [M.A. **14**–352] is confirmed. The orthite examined, sp. gr. 3-88 $\frac{1}{2}$ from the Vishnevogorsk deposit, has the composition SiO_2 31.71, Al_2O_3 17.82, Fe_2O_3 5.68, FeO 7.69, TiO_2 0.05, MgO

0.99, RE_2O_3 24.35, CaO 9.23, MnO 1.26, K_2O 0.64, Na_2O 0.14, H_2O 0.87 [=100.43]. Ca and Ce with substituents are located in crystallographically independent 2-fold positions at 0.760, 0.75, 0.153 and 0.601, 0.75, 0.426, respectively. The lack of cleavage in orthite, contrasting with the perfect (001) cleavage of the isostructural epidote, is accounted for by the stronger bonding in the Ce polyhedra. A. P.

PYATENKO (YU. A.) & PUDOVKINA (Z. V.). *On the crystal structure of narsarsukite*. Soviet Physics: Crystallography, 1960, **4**, 885–886, 1 fig. Translated from Kristallografiya, 1959, **4**(6), 929.

———. *Crystal structure of narsarsukite*. Soviet Physics: Crystallography, 1961, **5**, 540–548, 7 figs. Translated from Kristallografiya, 1960, **5**(4), 563–573.

The complete crystal structure investigation of narsarsukite $Na_2(Ti,Fe)(O,OH)(Si_4O_{10})$ has been undertaken. It was found that narsarsukite is tetragonal, the unit cell dimensions being a 10.72, c 7.99 Å. Atomic arrangement was determined by Patterson and Fourier syntheses. The space group is $I4/m$, cell content 4 formula units. Narsarsukite represents a new structure type with $(Si_4O_{10})_\infty$ chains stretching along c . The Si_4O_{10} chains or columns may be considered as stacked Si_4O_{12} rings centred on the 4_2 axes. The Ti's and the additional oxygens alternate at intervals of $c/4$ on the 4-fold axes, these additional oxygens and the unshared corners of the SiO_4 tetrahedra forming octahedra about Ti. The Na is in 7-fold coordination in the rather large channels parallel to c between the Si_4O_{10} and TiO_5 columns. A. P.

FOSTER (MARGARET D.). *Interpretation of the composition of lithium micas*. Prof. Paper U.S. Geol. Survey, 1960, **354-E**, 115–147.

A study of more than 100 analyses of lithium micas reported in the literature indicates that, compositionally, most of the lithium micas may be interpreted as if derived by isomorphous replacement from muscovite or siderophyllite. Starting with muscovite, analyses and formulas of aluminium-lithium micas, arranged in order of increasing Li content, are characterized by decrease in octahedral Al and in tetrahedral Al and by increase in Si and in octahedral occupancy. The term 'lithian' muscovite is given to aluminium lithium micas having a muscovite structure. Starting with siderophyllite, or other trioctahedral micas having high Fe^{2+} and very low Mg content, analyses and formulas of ferrous lithium micas, arranged in order of increasing Li content, are characterized by decrease in Fe^{2+} , decrease in tetrahedral Al, increase in Si, and increase in octahedral occupancy. Varietal definitions based on octahedral sites occupied by Li^+ in the half-cell formula are: lithian siderophyllite, having fewer than 0.25 sites occupied

by Li^+ ; protolithionite, having between 0.25 and 0.75 sites occupied by Li^+ ; zinnwaldite, having between 0.75 and 1.25 sites occupied by Li^+ ; and lepidolite, having more than 1.25 sites occupied by Li^+ . The high-Li members of both series are lepidolites. Thus lepidolites may be interpreted as if derived from muscovite or from siderophyllite. The names paucilithionite [M.M. 26-340] and lithium-muscovite [M.M. 25-635] are unsatisfactory; *trilithionite* is more appropriate for the hypothetical end-member that has a 3:1 Li-(octahedral)Al replacement ratio. The name cryophyllite [Cooke, 1867] should be discarded, for the material so designated is a ferroan lepidolite. [M.A. 9-121, 12-58, 421, 15-183] K. S.

KLEVTSOVA (R. F.) & BELOV (N. V.). *Crystal structure of spurrite*. Soviet Physics: Crystallography, 1961, 5, 659-667, 2 figs. Translated from Kristallografiya, 1960, 5(5), 689-697.

The cell dimensions and space group previously reported [M.A. 13-15] are confirmed. Determination of the structure by a different method than that used by Smith, Karle, Hauptman, and Karle [M.A. 15-98] leads to a confirmation of the published atomic parameters. The structure is considered as composed of layers of CaCO_3 with 'aragonite' configuration parallel to (001) alternating with double layers of $\alpha\text{-Ca}_2\text{SiO}_4$. Alternative explanations of the cleavage and twinning are offered. A. P.

KOMKOV (A. I.). *The structure of natural fergusonite, and of a polymorphic modification*. Soviet Physics: Crystallography, 1960, 4, 796-800, 4 figs., 2 tables. Translated from Kristallografiya, 1959, 4(6), 836-841.

Fergusonite from the Central Urals is found to be isostructural with scheelite, space group $I4_1/a$; a 5.16, c 10.89 Å; cell content $4(\text{Y}_{0.85}\text{Yb}_{0.15})\text{NbO}_4$. X-ray studies on fergusonite heated to 1000°C for 15 minutes and cooled to room temp. show that the mineral goes over to a monoclinic form with a 5.05, b 10.89, c 5.27 Å, β 94°30', cell content 4 formula units. A structure has been found for this form in the space group $I2$. Atomic coordinates have been determined for both structures. A. P.

ISUPOV (V. A.). *Geometrical criteria of the pyrochlore structure type*. Soviet Physics: Crystallography, 1958, 3, 96-97, 2 figs. Translated from Kristallografiya, 1958, 3(1), 99-100.

The pyrochlore structure may be characterized by 3 tolerance factors if the ideal formula is $A'A''\text{B}_2\text{O}_6\text{X}$ or by 2 if it is $\text{A}_2\text{B}_2\text{O}_7$. The factors have been calculated for 27 compounds and combinations of these formula types, 16 of which have the pyrochlore structure. It is clear that the value of the tolerance factor alone does not determine whether this structure is assumed. A. P.

PYATENKO (YU. A.). *Some aspects of the chemical crystallography of the pyrochlor[e]-group minerals*. Soviet Physics: Crystallography, 1960, 4, 184-186, 2 figs. Translated from Kristallografiya, 1959, 4(2), 204-208.

The structure of pyrochlore is derived from a multiple of the fluorite structure by the omission of 8 of the required 64 anions in the cube with doubled a . The wide range of compositions of pyrochlore type structures and the departure of many from the ideal formula are connected with this relation. Many metamict pyrochlore type minerals when heated show indications of the smaller cell corresponding to the fluorite type. A. P.

RUMANOVA (I. M.) & ZNAMENSKAYA (M. N.). *The crystal structure of anapaite*. Soviet Physics: Crystallography, 1961, 5, 650-658, 3 figs. Translated from Kristallografiya, 1960, 5(5), 681-688.

The cell dimensions reported by Wolfe [M.A. 3-218] are confirmed. The unit cell contains one $\text{Ca}_2\text{Fe}(\text{PO}_4)_2 \cdot 4\text{H}_2\text{O}$. A structure in the space group $P\bar{1}$ is determined from ordinary and modulated projections of the Patterson function on to the xy plane. The structure is basically composed of layers of oxygen octahedra centred by Fe and heptavertica centred by Ca which are parallel to (010) and joined by PO_4 tetrahedra. A. P.

SIMONOV (V. I.) & BELOV (N. V.). *The determination of the structure of amblygonite by the minimum-function method*. Soviet Physics: Crystallography, 1958, 3, 429-438, 6 figs., 3 tables. Translated from Kristallografiya, 1958, 3(4), 428-437.

The methods of arriving at the structure previously reported [M.A. 14-177] are described in detail. The source of the material examined is not disclosed but it is reported to have but an insignificant Na content. Space group $P\bar{1}$, cell content two $\text{LiAl}(\text{PO}_4)(\text{OH},\text{F})$, cell dimensions a 5.06, b 5.16, c 7.08 Å, α 109°52', β 107°30', γ 97°54'. The setting used may be obtained from that of Palache, Richmond, and Wolfe [M.A. 9-142], which is used by Baur, by the transformation $001/100/\bar{1}10$. [See following abstract] A. P.

BAUR (WERNER H.). *Die Kristallstruktur des Edelamblygonits $\text{LiAlPO}_4(\text{OH},\text{F})$* . Acta Cryst., 1959, 12, 988-994, 2 figs., 7 tables.

The structure of clear, transparent crystals of amblygonite from Newry, Maine, has been solved by Patterson Fourier, and difference projections. Cell constants in the setting adopted are a 5.18, b 7.15, c 5.04 Å, α 112°07', β 97°48', γ 67°53'. The structure found is similar to that reported by Simonov and Belov [preceding abstract] but there are marked differences in the atomic parameters which are beyond the limits of experimental error. In this

work Li is found to occupy only one position, with coordination number 5. Simonov and Belov found Li in the same cavity at random in two positions separated by 0.5 Å. It may be that the crystal from Maine is a low-temp. form, the other a high-temp. form.

A. P.

CAROBBI (G.) & MAZZI (F.). [On the possible partial substitution of calcium by uranium in the lattice of apatite.] Atti accad. naz. Lincei, Mem. Cl. Sci. fis. mat. nat., Sez. IIa, 1959, **5**, 159–171.

R. A. H.

RUMANOVA (I. M.) & MALITSKAYA (G. I.). Revision of the structure of astrakhanite by weighted phase projection methods. Soviet Physics: Crystallography, 1960, **4**, 481–495, 4 figs., 6 tables. Translated from Kristallografiya, 1959, **4**(4), 510–525.

The previously determined [M.A. 14–26] structure of blödite [astrakhanite] has been refined. The essential features of the structure are not changed.

A. P.

PAVLOV (P. V.) & BELOV (N. V.). The structures of herderite, datolite and gadolinite determined by direct methods. Soviet Physics: Crystallography, 1960, **4**, 300–314, 8 figs. Translated from Kristallografiya, 1959, **4**(3), 324–340.

The structure of datolite, $\text{CaBSiO}_4(\text{OH})$, and of gadolinite, $\text{Y}_2\text{FeBe}_2\text{O}_2(\text{SiO}_4)_2$, found by Ito, Mori, and Sadanaga [M.A. 12–336] is confirmed. Herderite, CaBePO_4F , is isostructural with these. The application of Harker-Kasper inequalities and of statistical analysis by Zachariasen's methods to the diffraction data from herderite is discussed.

A. P.

ANDERSSON (STEN) & WADSLEY (A. D.). Five co-ordinated titanium in $\text{K}_2\text{Ti}_2\text{O}_5$. Nature, 1960, **187**, 499–500, 2 figs.

C. H. K.

Twining, growth, &c.

INDENBOM (V. L.). On the possibility of optical detection of Dauphiné twinning in quartz. Soviet Physics: Crystallography, 1957, **2**, 79–85, 2 figs. Translated from Kristallografiya, 1957, **2**(1), 83–88.

The possibility of optically detecting Dauphiné twinning in stressed quartz crystals is considered. Experimental tests have not been made.

A. P.

KERN (RAYMOND) & REHN (BRIGITTE). Étude expérimentale de la formation des macles de croissance du gypse. C.R. Acad. Sci., Paris, 1960, **251**, 1300–1302.

The frequency of the various twins is dependent on the degree of supersaturation of the solution.

E. J. & A. S.

SCHNERB (I.) & BLOCH (M. R.). On the influence of metal salts on the crystallisation of potassium chloride from supersaturated solutions. Bull. Res. Council Israel, 1958, **7A**, 179–185, 4 figs.

The cubic habit of sylvine is deformed and the crystals become non-transparent in the presence of Fe^{3+} ions, at concentrations >1.5 mg Fe per 100 ml solution. They develop octahedral faces in the presence of Sn^{2+} ions (at conc. >1.6 mg per 100 ml solution). The presence of sodium sulphide represses these effects. Stannous and lead salts retard the crystallization from supersaturated KCl solutions.

D. H. Y.

KENAT (J.), GLASNER (A.), & BLOCH (M. R.). The absorption of lead by potassium chloride crystallising from a solution containing small amounts of lead chloride. Bull. Res. Council Israel, 1958, **7A**, 224–225.

The quantity of lead entering sylvine crystals was proportional to the crystallization velocity and to the concentration of lead in the solution; the crystals grew larger than usual, and developed octahedral faces.

D. H. Y.

SUNAGAWA (ICHIRO). Variation of crystal habit of pyrite. Rept. Geol. Survey Japan, 1957, no. 175, 41 pp., 16 figs., 10 pls., 10 tables, (English with Japanese summary).

Habit variations of pyrite from many localities in Japan, representing the principal types of occurrence, have been studied systematically. The variation of habit with grain size, differences in coexisting minerals, situation in the deposits, depth of veins, and other factors has been determined. The influence of impurities on habit is recognized only under some limited conditions. Circumstances of crystallization are considered to control habit. It is concluded that moderate temperature, slow cooling, and sufficient supply of solution favour octahedral or pentagonal habit, whereas extremely high or low temperature, rapid cooling or insufficient supply of solution favour cubic habit. The 10 plates show photomicrographs ($\times 20$ or $\times 10$) of the details of crystal faces. [See following abstract]

A. P.

ABDULLAEV (G. K.). Some new simple forms of pyrite. Soviet Physics: Crystallography, 1957, **2**, 307–308.

Translated from Kristallografiya, 1957, **2**(2), 307–308.

Goniometric study of 225 pyrite crystals from 20 localities in Azerbaijan revealed a total of 113 crystal forms, including 29 new forms for which two-circle angles are reported. [See preceding abstract]

A. P.

MOKIEVSKIĬ (V. A.) & SHAFRANOVSKIĬ (I. I.). Symmetry, antisymmetry and pseudosymmetry of nucleation surfaces. Soviet Physics: Crystallography, 1957, **2**, 19–23, 7 figs., 4 tables. Translated from Kristallografiya, 1957, **2**(1), 23–28.

Nucleation surfaces have been studied in variously oriented crystal growths of potassium alums. A. P.

MIKHEEV (V. I.) & SHAFRANOVSKIĬ (I. I.). *Edge forms and striation on crystals*. Soviet Physics, Crystallography, 1957, **2**, 158-162, 7 figs. Translated from Kristallografiya, 1957, **2**(1), 166-171.

All the simple edge forms for the lower and middle crystal systems are investigated. Possible types of striations on crystal faces correspond to these. [M.A. 14-175] A. P.

GENDELEV (S. SH) & SHAFRANOVSKIĬ (I. I.). *Edge forms of the cubic system*. Soviet Physics: Crystallography, 1958, **3**, 407-416, 5 figs., 2 tables. Translated from Kristallografiya, 1958, **3**(4), 405-415.

All edge forms in class $m\bar{3}m$ are pictured and tabulated and the numbers of such forms in the remaining classes of the isometric system are indicated. A. P.

SHAFRANOVSKIĬ (I. I.). *An extended study of crystal forms and the crystal morphology of twins*. Soviet Physics: Crystallography, 1961, **5**, 504-508, 4 figs. Translated from Kristallografiya, 1960, **5**(4), 525-529.

The new concepts of vertex and edge forms contribute to the description of the complex forms of crystals (the skeleton formations, etc.). The simple face forms with reentrant angles together with the formula for colour symmetry give an exhaustive description of twins. [See preceding abstracts] A. P.

FRANK-KAMENETSKIĬ (V. A.). *Oriented crystallization of $KMnO_4$ and $KClO_4$ on barytes*. Soviet Physics: Crystallography, 1957, **2**, 706-707, 3 figs., 3 tables. Translated from Kristallografiya, 1957, **2**(5), 713-715.

The orientation of $KMnO_4$ and $KClO_4$ crystals deposited from solution of the (001) faces of baryte has been studied. 81.5% of the former and 96.7% of the latter were found to be oriented. This difference can be explained by dimensional relations. A. P.

JACCODINE (R. J.). *Crystal growth in paraffin*. Nature, 1960, **187**, 498-499, 3 figs. C. H. K.

TURCHÁNYI (GY.) & TARJÁN (I.). *Sodium chloride whiskers*. Nature, 1961, **190**, 79-80, 3 figs.

Spiral whiskers were grown from vapour.

M. J. LeB.

EMARA (S. H.). *Spiral formation on natural crystalline sulphur*. Nature, 1961, **190**, 254-255, 1 fig.

Screw dislocations on (001) faces gave step heights of 100 Å to 5000 Å.

M. J. LeB.

LEFEVER (R. A.) & CHASE (A. B.). *Growth spirals of synthetic magnetoplumbite crystals*. Nature, 1961, **190**, 255-256, 3 figs.

Spiral growth on the (0001) faces of tabular $PbFe_{12}O_{19}$ crystals gave growth spirals with reversal of curvature. A step height of 163 Å (7 unit cells in the c direction) was obtained. These steps were observed to dissociate into smaller components. M. J. LeB.

PHILLIPS (V. A.) & CANNON (P.). *Dislocations in layered structures*. Nature, 1960, **187**, 313-314, 2 figs.

A description of transmission electron micrographs of cleavage fragments of molybdenite and high-purity, well-ordered graphite. C. H. K.

GILLET (M.). *Études des défauts cristallins par les moirés sur des cristaux d'or et de molybdénite*. Bull. Soc. franç. Min. Crist., 1960, **83**, 245-249, 11 figs.

The observation under the electron microscope and interpretation of moiré patterns produced by crystal dislocations, are discussed. In particular, moiré patterns produced by the superposition of two crystals of gold or of molybdenite are investigated. [M.A. 14-311] R. A. H.

SILK (E. C. H.) & BARNES (R. S.). *The observation of dislocations in mica*. Acta Metall., 1961, **9**, 558-562, 5 figs.

Thin cleaved fragments of mica were examined in the electron microscope. They were found to contain dislocations lying in the cleavage planes. The dislocations formed by slip, interact simply. The superposition of loose sheets of mica was used to produce moiré patterns which revealed dislocations which were perpendicular to the cleavage plane. R. G. Wls.

AMELINCKX (S.) & DELAVIGNETTE (P.). *Electron microscope observations of dislocations in talc*. Journ. Appl. Phys., 1961, **32**, 341-351, 18 figs.

Dislocations in talc appear to be dissociated into four partial dislocations separated by their stacking fault ribbons. This phenomenon can be interpreted in terms of the known structure of talc. The stacking fault energy can be estimated from the equilibrium condition of the four partials. Complicated networks resulting from the interactions of ribbons are observed. A number of striking contrast effects are also described. R. G. Wls.

MUGURAMA (J.). *Spiral etch-pits of ice crystals*. Nature, 1961, **190**, 37-38, 3 figs.

M. J. LeB.

GOLDBERG (P.). *Etch pits in electroluminescent zinc sulfide crystallites*. Journ. Appl. Phys., 1961, **32**, 1520–1524, 7 figs.

Etchants of aqueous hydrogen peroxide solution were used to develop triangular etch pits on certain surfaces of synthetic, electroluminescent zinc sulfide powders and on cleaved fragments of natural crystals of sphalerite. The etch pits appear physically related to striations since the pits form only on those faces bearing the striations. All triangular pits on a given face point in the same direction, which is normal to the striation direction. This direction is one of the crystallographic polar axes in sphalerite and it is the *c*-axis in wurtzite. The pits are essentially absent in non-electroluminescent, synthetic zinc sulfide powders. The possible interpretations of the pits and striations are discussed in terms of defect structures, e.g. dislocation and stacking faults.

R. G. Wls.

MENDELSON (S.). *Dislocation etch pit formation in sodium chloride*. Journ. Appl. Phys., 1961, **32**, 1579–1583, 9 figs.

Dislocation etch pits were formed on the (100) surfaces of NaCl crystals by etching in a solution of FeCl₃ in glacial acetic acid. Observations and arguments are presented to illustrate the reliability of the etching technique to reveal dislocations at positions where they intersect the crystal surface.

R. G. Wls.

PHILLIPS (W. L., Jr.). *Room-temperature deformation and fracture characteristics of lithium-fluoride single crystals*. Trans. Metall. Soc., A.I.M.E., 1961, **221**, 35–44, 15 figs.

The deformation and fracture characteristics of lithium-fluoride single crystals stressed in compression at room temperature are reported. In *as*-cleaved specimens the stress-strain curves are variable. Two types of {110} fractures were observed in the vicinity of kink bands. The stress-strain curves of annealed crystals were found to be reproducible; {100} cracks formed which propagated along the {100} and {110} planes. The deformation and fracture characteristics were affected by quenching and X-ray irradiation.

R. G. Wls.

CARNAHAN (R. D.), JOHNSTON (T. L.), STOKES (R. J.), & LI (C. H.). *Effect of grain size on the deformation of polycrystalline silver chloride at various temperatures*. Trans. Metall. Soc., A.M.I.E., 1961, **221**, 45–49, 6 figs.

When silver chloride (cerargyrite) deforms by pencil glide at temperatures of 26° and –72°C, grain size was found to have no effect upon the proportional limit, and the material thins down to a knife edge under tension. At –196°C, deformation was found to take place on fewer slip systems to produce straight slip traces. The flow stress became sensitive to grain size and fracture occurred by cleavage from an intergranular source without any reduction in area.

R. G. Wls.

PYATENKO (YU. A.) & ALEKSANDROV (V. B.). *The recrystallization texture of a metamict mineral*. Soviet Physics: Crystallography, 1960, **4**, 227–228, 3 figs. Translated from Kristallografiya, 1959, **4**(2), 248–249.

X-ray diffraction from a heated polycrystalline fragment shows that the reconstituted material consists of partly oriented crystallites.

A. P.

ECONOMIC MINERALS AND ORE DEPOSITS

General

CHAURIS (L.). *Carte des gîtes minéraux de la France au 1:320 000-e, feuille Cherbourg-Rennes*. Publiée par le Bureau de Recherches géologiques et minières (B.R.G.M.), Paris.

E. J. & A. S.

WAHL (W. G.). *An interpretive technique for delimiting mineral potential areas based on the magnetic susceptibility of source rocks*. Rept. 21st Intern. Congr., Norden, 1960, Part **2**, 200–215, 9 figs.

The magnetic susceptibility of syenites, quartz syenites, and granites is related to the Cu, Pb, and Zn contents of the rock. Igneous rocks with a low magnetic susceptibility tend to have associated mineral deposits, but the latter are not usually found around intrusive rocks which have a high susceptibility. Examples are given of three acidic stocks southeast of Bancroft, Ontario, with differing magnetic susceptibility, and Fe, Cu, Pb, and Zn values: the Deloro

granite has the lowest susceptibility and lowest metal content but 30 metalliferous deposits occur within half a mile of the contact.

R. A. H.

PAARMA (H.) & LEVANTO (A.). *On the use of magnetic measurements in ore prospecting*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **2**, 98–110, 10 figs.

Case histories are presented for the use of various improved types of magnetic measurements in prospecting for ore at three localities in Finland [no mention is made of the type of ore].

R. A. H.

[ELISEEV (E. N.).] Елисеєв (Э. Н.). Геохимия главнейших сульфидных медно-никелевых провинций СССР [The geochemistry of the principal sulphide copper-nickel provinces of the U.S.S.R.]. Проблемы геохимии. I. Изд. Львов Унив. [Problems of geochemistry. I. Publ. Lvov Univ.], 1959, pp. 6–183, 53 figs., (English summary, pp. 301–309). Also issued as a separate publication.

This is an extensive treatise of the Cu-Ni ores of the Monche Tundra, Pechenga, and Norilsk, well documented and well illustrated by photographs and diagrams. Part I (pp. 8-17) deals briefly with the methods of field survey and geochemical studies of copper-nickel ore deposits. Part II (pp. 17-39) deals with the distribution of the chemical elements, the distribution of minerals in the ore bodies, and the genetic classification of ores. Part III (pp. 39-100) deals with the occurrence of the chemical elements in rocks, ores, and minerals, and reviews these elements and their distribution during the process of differentiation in the magma leading to the formation of the ore bodies. Part IV (pp. 100-141) deals with the geochemistry of nickel and its distribution in rocks and minerals. Part V (pp. 141-178) deals with the geochemistry of the processes of ore genesis, and with the paragenesis of minerals and the geochemistry of hydrothermal processes. References (pp. 179-183) contain a large number of titles of books and papers in the Russian language.

S. I. T.

[GORZHEVSKIĬ (D. I.) & ROSSMAN (G. I.)] Горжевский (Д. И.) и Россман (Г. И.). Первичные ореолы рассеяния полиметаллических месторождений рудного Алтая [*Primary aureoles of dispersion of polymetallic deposits of the ore-bearing Altai*]. Проблемы геохимии. I. Изд. Львов Унив. [Problems of geochemistry. I. Publ. Lvov Univ.], 1959, pp. 184-189, (English summary, p. 309).

The variation in size and shape of the primary dispersion aureoles of Zn, Cu, and Pb sulphide deposits depends on structural-lithological factors as well as on the nature of the chemical elements involved.

S. I. T.

[LAZARENKO (E. K.)] Лазаренко (Е. К.). Геохимическая характеристика распределения элементов в медно-цинковых месторождениях Среднего Урала [*Geochemical characteristics of the distribution of chemical elements in copper-zinc deposits of the Middle Urals*]. Проблемы геохимии. I. Изд. Львов Унив. [Problems of geochemistry. I. Publ. Lvov Univ.], 1959, pp. 190-217, 13 figs., (English summary, pp. 309-311).

Numerical data and diagrams provide background to a discussion on the various factors determining the distribution of chemical elements in the Cu-Zn ores. These factors comprise geological setting, degree, and nature of mineralization, genetic aspects, and quantitative relations among the elements.

S. I. T.

[LAZARENKO (E. K.) & MERLICH (B. V.)] Лазаренко (Е. К.) и Мерлич (Б. В.). Принципы минералого-промышленной классификации сложных сульфидных руд [*Principles of mineral-industrial classification of composite sulphide ores*]. Проблемы геохимии. I. Изд. Львов Унив. [Problems of geochemistry. I. Publ. Lvov Univ.], 1959, pp. 218-227, (English summary, p. 311).

An outline of a new type of classification of sulphide ores is given, in which not only the purely mineralogical composition of ores is taken into account, but also their geological setting, mode of extraction, and economic possibilities.

S. I. T.

[GOLEVA (G. A.)] Голева (Г. А.). Геохимия подземных вод месторождений полезных ископаемых западных областей Украины [*Geochemistry of subterranean waters of ore deposits of the western districts of the Ukraine*]. Проблемы геохимии. I. Изд. Львов Унив. [Problems of geochemistry. I. Publ. Lvov Univ.], 1959, pp. 228-246, 1 fig.

Ground waters associated with sulphide ores and petroleum and gas deposits are described in terms of major and trace elements, and their main characteristics are outlined.

S. I. T.

[MERLICH (B. V.)] Мерлич (Б. В.). О генетических соотношениях ртути и свинцово-цинкового брудения в Закарпатье [*Genetic and geochemical correlations of quicksilver and lead-zinc mineralization in the Transcarpathians*]. Проблемы геохимии. I. Изд. Львов Унив. [Problems of geochemistry. I. Publ. Lvov Univ.], 1959, pp. 249-255, (English summary, p. 312).

The study of mercury and lead-zinc ores shows that these two types of ore belong to two distinct genetic branches. It is shown that minerals of the mercury ores began their formation at much higher temperatures than the end-crystallization minerals of the lead-zinc mineralization.

S. I. T.

Metallic ore minerals and deposits

MOLLY (E. W.). *Platinum deposits of Ethiopia*. Econ. Geol., 1959, **54**, 467-477, 2 figs.

A platinum deposit occurs in crystalline basement rocks of Ethiopia. The deposit in dunite, although at present uneconomic, is similar to deposits in the Urals and dissimilar to those of South Africa. 'Birbirites'—very hard brownish rocks of quartzitic aspect—occur over the dunite and are the result of deep alteration of it. Economic concentrations may be found in related occurrences of platinumiferous alluvium.

W. E. H.

BOYLE (R. W.). *The geochemistry, origin and role of carbon dioxide, water, sulfur, and boron in the Yellowknife gold deposits, Northwest Territories, Canada*. Econ. Geol., 1959, **54**, 1506-1524, 6 figs., 4 tables.

The principal economic deposits of the Yellowknife district occur in quartz-carbonate lenses in extensive chlorite schist zones (shear zones) cutting greenstone (amphibolite). The other deposits, of less economic

importance, occur in quartz lenses in meta-sedimentary rocks. The deposits in the greenstones represent concentrations of silica, carbon dioxide, water, sulfur, arsenic, antimony, gold, and other metallic elements. Those in the sediments represent concentrations of silica, sulfur, boron, gold, and other metallic elements. For the deposits in the greenstones chemical evidence is presented to show that, under the influence of a strong thermal gradient, some of the carbon dioxide, water, sulfur, gold, silver, and other metallic elements in the original volcanic rocks migrated into the extensive shear zone systems. In these water and carbon dioxide reacted with amphibolite to produce extensive widths of chlorite and chlorite-carbonate schist. Silica, sulfur, gold, and numerous other elements present in the rock were mobilized and, together with those added by diffusion from the country rocks, migrated into dilatant zones, principally at shear zone junctions and flexures. In these sites they were precipitated as quartz, carbonates, sulfides, and gold. A similar process operated to form the gold-quartz lenses in the meta-sediments; silica, boron, sulfur, and various metallic elements were mobilized during the metamorphism of the sediments and migrated into and were precipitated in dilatant zones in faults, fractures, and drag folds.

W. E. H.

FUKUYAMA (KENZÔ). *Geology and ore deposit of the Arakawa mine, Kagoshima Prefecture*. Kumamoto Journ. Sci., ser. B, 1954, **1**, no. 4, 19-89, 14 pls., 16 figs., 3 tables, 1 geol. map.

The Arakawa mine produces gold and silver from a series of veins the most important of which are in andesite altered to propylite in the vicinity of the ores. The geology and petrography of the enclosing rocks and the structure and mineralization of the veins are described in detail. The optical properties of the minerals—plagioclase, hornblende, augite, hypersthene, and olivine—of the lavas are detailed. The main mineralization comprised the deposition of auriferous quartz and vein calcite with acanthite, a little chalcopryrite, and pyrite. Following brecciation gold-silver telluride minerals were introduced. Later there was minor deposition of chalcedony, calcite, and laumontite; for the latter, α 1.514, β 1.525, γ 1.526, $2V\alpha$ 34° , $\gamma':c$ 22° , and chem. anal., by H. Matsumoto is SiO_2 51.37, Al_2O_3 20.21, FeO 0.02, MgO 0.24, CaO 10.58, Na_2O 0.41, $\text{H}_2\text{O}+$ 15.94, $\text{H}_2\text{O}-$ 1.39, = 100.16.

A. P.

WAYLAND (RUSSELL G.). *Tofty tin belt, Manley Hot Springs district, Alaska*. Bull. U.S. Geol. Survey, 1961, **1058-1**, 363-414, 1 fig., 4 pls., 4 tables.

Buried placer deposits of late Cenozoic age contain cassiterite, associated with brown tourmaline (dravite), and gold.

K. S.

[ELISEEV (N. A.), GORBUNOV (G. I.), ELISEEV (E. N.), MASLENIKOV (V. A.), & UTKIN (K. N.)] Елисеєв (Н. А.), Горбунов (Г. И.), Елисеєв (Э. Н.), Маслеников (В. А.) и Уткин (К. Н.). Ультраосновные и основные интрузии Печенги [*Ultrabasic and basic intrusions of Pechenga*]. Изд. Акад. Наук СССР [Publ. Acad. Sci. U.S.S.R.], 1961, 357 pp., 175 figs. Price 2r. 22k.

In this volume the first 119 pages are devoted to description of the rocks, and the remaining 227 pages to description of the copper-nickel ores of Pechenga (Finnish: Petsamo), while pp. 347-355 give the bibliography. The Cu-Ni sulphide ores are associated with ultrabasic intrusive sills intruding tuffaceous, sedimentary, and lava series of an Upper Proterozoic age. The richest ores are found at the lower contact of the differentiated serpentinite (altered peridotite) — alkali gabbro complexes, being found disseminated in the igneous rock as well as in the underlying tectonic breccia and other contact rocks. Over a hundred such differentiated sills are recorded. According to all evidence the sulphide mineralization occurred during the final magmatic phase of autometasomatism and the superimposed hydrothermal phase. A detailed description of rocks and ores is given, supported by numerous chemical analyses and other data. The ore minerals are described in a separate chapter. The principal minerals are pentlandite, pyrrhotine, chalcopryrite, pyrite, ilmenite, and magnetite. Minerals of the zone of oxidation include covellite, violarite, malachite, azurite, and others. Among these occurs iron-magnesium reitersite which is described in detail. The ore minerals are associated with a series of silicate minerals belonging to the hydrothermal stage such as serpentine, talc, chlorite, carbonates, and others. The following types of ores are described: mineralized tectonic breccia, compact ore, pyrrhotine, compact ore, banded ore, mineralized serpentinite (grey ore), mineralized phyllite, disseminated ore, and recrystallized ore (matt ore). The geochemistry of nickel and the genesis of the ores are discussed in detail.

S. I. T.

FREEMAN (G. A.), RAMPACEK (CARL), & EVANS (L. G.). *Copper segregation at the Lake Shore mine*. Journ. Metals, 1961, **13**, 370-372, 1 fig.

A segregation process is described for concentrating copper from oxide ores and other ores not amenable to conventional treatment.

R. G. Wls.

STOIBER (R. E.) & DAVIDSON (E. S.). *Amygdale mineral zoning in the Portage Lake lava series, Michigan copper district. Part I*. Econ. Geol., 1959, **54**, 1250-1277, 9 figs., 3 tables.

The most common suite of the so-called 'amygdale-minerals' comprises calcite, chlorite, epidote, quartz,

prehnite, native copper, and laumontite which occur in flow tops and conglomerates of Keweenaw age. These amygdale minerals occur in three regional zones which overlap one another. The zones are distinguished by the relative predominance of prehnite, epidote, and quartz. Copper occurs in the epidote zone near its boundary with the quartz zone and is either finely disseminated or in small to large masses, the largest occurring in fractures. Copper is rare in parts of flow tops where laumontite is abundant. Geologic thermometry indicates that quartz and calcite amygdules were deposited at a maximum temperature of 360°C in the Kersarge district.

J. T. W.

STONE (JOHN W.). *Ore genesis in the Naica District, Chihuahua, Mexico*. Econ. Geol., 1959, **54**, 1002-1034, 7 figs.

Pyrometasomatic and mesothermal replacement bodies of basemetal sulfides with minor amounts of silver and gold occur in a thick sequence of locally marmorized Cretaceous limestone. Two principal types of orebodies are exposed; silicate-sulfide sheets or 'mantos', and chimneys of sulfide ore with or without minor silicates. In the mantos, silicates were deposited first, followed by sulfides that formed at temperatures of the order 500°-550°C. In the silicate chimneys, quartz and calcite occur together in the presence of contemporaneous sphalerite that crystallized at about 500-550°C.

G. S. C.

McKINSTRY (H.). *Mineral assemblages in sulfide ores: the system Cu-Fe-S-O*. Econ. Geol., 1959, **54**, 975-1001, 7 figs.

A quaternary model is presented based on the four ternary diagrams; Cu-Fe-S, Cu-S-O, Fe-S-O, and Cu-Fe-O. Associations such as chalcocite-magnetite, covellite-magnetite, cubanite-hematite, and bornite-cuprite are rare or non-existent. Natural associations—magnetite-chalcopyrite, magnetite-cubanite, and hematite-chalcopyrite—are to be expected from the model. In the quaternary system, containing oxygen, the trend usually indicated in primary ore deposition is toward assemblages progressively richer in sulfur and poorer in oxygen. Late stage reversals of the trend may occur by a progressive decrease in the sulfur supply.

G. S. C.

KANEHIRA (KEIICHIRO). *Geology and ore deposits of the Chihara mine, Ehime Prefecture, Japan*. Journ. Fac. Sci. Tokyo Univ., 1959, **11**, 309-339, 29 figs., 2 pls.

The structural relations and fabrics of the ores and enclosing rocks of several cupriferous pyrite deposits, found concordantly in the Sambagawa crystalline schists of the Chihara district, are described in detail. The fabrics of the ores are in harmony with those of the schists.

A. P.

YAMAOKA (KAZUO). *On the apophyses of ore bodies found at the Shirataki mine in Shikoku (mainly with regard to mineral paragenesis and minor elements)*. Kumamoto Journ. Sci., ser. B, sect. 1, 1957, **2**, no. 2, 123-131, 3 figs., 3 pls., 1 table.

Peculiar apophyses exist in the Shirataki mine. They are constituted mainly of chalcopyrite, bornite, and chalcocite. The results of spectrographic tests for 48 elements are reported for 14 samples of sulfides from the apophyses, 23 samples of sulfides from the principal stratiform ore bodies and 10 samples of the country rocks, mostly schists. The mineral assemblages and minor elements in the ore show great differences between the apophyses and the stratiform or lenticular ore bodies.

A. P.

IWAO (SHŪICHI), KISHIMOTO (FUMIO), & TAKAHASHI (KIYOSHI). *Wall rock alteration of the Kosaka mine, Akita Prefecture, Japan*. Rept. Geol. Survey, Japan, 1954, no. 162, 31 pp., 20 figs., 4 pls., (English with Japanese summary).

The limited mineral assemblages of the altered rock associated with these epithermal Cu-Pb-Zn deposits in Tertiary dacite or rhyolite indicate formation at 350°-400°C at a depth of 2-3 km. In this restricted pressure-temperature range pH is considered the principal factor determining zoning within the altered rocks. Sparse kaolinitic alteration superimposed on the general alteration, is far later.

A. P.

STANTON (R. L.) & RUSSELL (R. D.). *Anomalous leads and the emplacement of lead sulphide ores*. Econ. Geol., 1959, **54**, 588-607, 5 figs.

Anomalous leads of a galena-bearing deposit must have migrated some distance through crustal rocks to their present position. Such deposits are epigenetic. Ordinary and regular leads may be syngenetic and derived from below the crust.

G. S. C.

THIEBAUT (JEAN) & WEPPE (MAURICE). *Le gisement de fer de Lastric (Ariège) et ses relations avec l'épisyénite*. C.R. Acad. Sci., Paris, 1960, **250**, 4397-4398.

The Lastric iron mine occurs in a zone of mylonitized gneiss cut by an episyenite.

E. J. & A. S.

COURTY (G.). *Sur les rapports de l'oligiste et de la sideros dans l'hématite de Saint Rémy (Calvados)*. C.R. Acad. Sci., Paris, 1960, **250**, 2237-2238.

E. J. & A. S.

PARK (CHARLES F., Jr.). *The origin of hard hematite in itabirite*. Econ. Geol., 1959, **54**, 573-587, 9 figs.

Two principal classes of hard hematite occur in itabirite

the one formed by normal weathering processes, and the other by migration and rearrangement during regional metamorphism. The hard hematite formed from normal weathering processes is probably more common than other types.

G. S. C.

LUBER (N. KING). *Some aspects of the origin of the Ironwood iron-formation of Michigan and Wisconsin*. Econ. Geol., 1959, **54**, 82-118, 6 figs., 11 tables.

Part of the iron-formation consists of wavy-bedded magnetite and silicate-rich rocks; other members include vein-bedded carbonate, silicate, magnetite, and pyrite-rich rocks. Deposition took place in off-shore basins where circulation was limited and differences in rocks within the Ironwood iron-formation reflect differing physical and chemical conditions during continuous deposition of these primary facies.

W. E. H.

HILL (F. J.) & TIEMANN (T. D.). *The hydrogen reduction of a low-grade siliceous iron ore*. Trans. Metall. Soc., A.I.M.E., 1961, **221**, 68-72, 6 figs.

Sized fractions of Wisconsin Gogebic taconite were reduced with hydrogen over the temperature range from 00° to 1000°C. In general, the degree and rate of reduction increase with temperature. Particle size has no observable effect except in the smaller fractions at 900°C and above, where reduction is impeded possibly due to the siliceous nature of the ore. Gaseous diffusion appears to be significant as a rate controlling factor at certain stages.

R. G. Wls.

KAMAOKA (KAZUO). *Spectrographic studies on the trace elements in pyrite*. Kumamoto Journ. Sci., ser. B, sect. 1, 1958, **3**, no. 1, 31-37, 2 figs., 2 pls., 3 tables.

Pyrite (29 samples) and arsenopyrite (9 samples) from 17 mines in Japan were spectrographically examined for trace elements. Petrogenetic elements, derived probably from the country rocks, are more or less uniformly distributed as trace elements in pyrite. Pyrite from the cupriferous pyritic deposits of Besshi type contains Co in generally uniform distribution. Trace elements suggest the character of the mineralization of some metallogenetic provinces; e.g., Sn and Sb in pyrite from the Sn province on the periphery of the Sobo-Katamuki mountain block. Some trace elements are controlled by the temperature of the mineralizing fluid; Sb and Te, recognized frequently in pyrite from low temperature ore deposits, were not detected in pyrite from high temperature ore deposits.

A. P.

FOURAVSKY (GEORGES). *Composition chimique et nomenclature des bi- et tri-arséniures de cobalt, nickel et fer*. Notes et Mémoires Serv. géol. du Maroc, 1959, **18**, 161-178.

Numerous analyses of arsenides of cobalt, nickel, and iron collected from the deposits of the Bou-Azzer region (Anti-Atlas) have allowed the role of sulphur in the composition of skutterudite to be stated precisely as $(\text{Co,Ni,Fe})(\text{AsS}_{0.5})_3$. The view of R. J. Holmes [M.A. 10-204] is confirmed, namely, that cubic di-arsenides do not exist, and that the orthorhombic diarsenides form distinct isomorphous series, one of Co-Fe-Ni and the other of Ni-Co-Fe.

E. J. & A. S.

ROY (SUPRIYA). *Mineralogy and texture of manganese ore bodies of Dongari Buzburg, Bhandara district, Bombay State, India, with a note on their genesis*. Econ. Geol., 1959, **54**, 1556-1574, 14 figs., 7 tables.

The manganese ores have two principal modes of occurrence: (1) as massive ore bodies associated with gondites containing braunite, manganite, jacobsonite, and vredenburghite with minor secondary pyrolusite and cryptomelane, and (2) cavernous, botryoidal, kidney-shaped, banded, principally manganese dioxide ores containing cryptomelane, psilomelane, coronadite, pyrolusite, and manganite. Textures are indicative of deposition in open spaces. In the mixed ore of the two groups jacobsonite is enveloped in minerals of colloidal origin (i.e., pyrolusite and cryptomelane) with little or no replacement. The paragenetic sequence, based on textural relationships, indicates that the massive gonditic ore formed initially by metamorphism of early maganiferous sedimentary rocks. Elevation of temperature resulted in recrystallization and growth of coarse braunite and jacobsonite and the destruction of primary pyrolusite and manganite. The second ore type is much later and is the result of the influx of colloidal gels into porous and foliated mica schists.

J. T. W.

CAMERON (E. N.) & EMERSON (M. E.). *The origin of certain chromite deposits of the eastern part of the Bushveld Complex*. Econ. Geol., 1959, **54**, 1151-1213, 52 figs., 3 tables.

Field and laboratory studies indicate that the layered structure of the chromite-bearing zones of the Bushveld Complex is essentially the result of gravitative accumulation of early-formed crystals. Irregularities in layering and other features suggest, however, that the magma was at times in motion. There is also evidence—textural features, bronzite-chromite overgrowths on xenoliths, and chromite veinlets in xenoliths—to justify the conclusion that chromite in the high-grade chromitite members of the Steelport and Leader Seams has crystallized in part in situ, following partial resolution.

W. E. H.

KITAHARA (JUN-ICHI). *Studies on the chromites and their occurrences in the Tari district, Tottori Prefecture (1st Rept.) (I)*. Journ. Japanese Assoc. Min., Petr., & Econ. Geol., 1958, **42**, 1-9, 5 figs., (Japanese with English summary).

- — (1st Rept.) (II). Ibid., 1958, **42**, 90–100, 2 figs., 6 tables, (Japanese with English summary).
- — (2nd Rept.). Ibid., 1958, **42**, 114–128, 2 figs., 4 tables, (Japanese with English summary).
- — (3rd Rept.). Ibid., 1959, **43**, 42–54, 3 figs., 5 tables, (Japanese with English summary).

Geology and ore deposits of chromites in the Tari district, Tottori Prefecture, Japan are described in detail in the first report (I) and microscopic observations and 21 chemical analyses as well as sp. gr. of chromites are presented in the second section. In the second report, the petrography of country rocks, granites, granite-porphyry, quartz-porphyry, serpentine, and gabbros, is described, with chemical analyses of one granite, 14 serpentines, and 5 gabbros. In the third report, the petrography of dykes of dioritic, leucocratic and bastitic rocks, and the mineralogy of metamorphic minerals, such as clinocllore and garnet, formed by the intrusion of ultrabasic rocks are described. Chemical analyses of 5 diorites, 2 leucocratic and one bastitic rock are presented. Optical properties of clinocllore are α 1.575, γ 1.581, $\gamma - \alpha$ 0.006, $c : \gamma$ 1.9°. Chemical analysis of clinocllore by the author shows SiO_2 31.38, TiO_2 0.00, Al_2O_3 19.85, Cr_2O_3 0.18, Fe_2O_3 2.18, FeO 0.77, NiO tr., MnO 0.00, MgO 31.52, CaO 0.59, Na_2O 0.03, K_2O 0.01, $\text{H}_2\text{O} +$ 12.51, $\text{H}_2\text{O} -$ 0.97, =99.99. Garnet occurs as dodecahedral crystals with small form n (211); sp. gr. 3.759; n 1.849. Chemical analysis of garnet by the author shows SiO_2 35.97, Al_2O_3 5.82, Fe_2O_3 19.90, Cr_2O_3 3.11, TiO_2 0.89, FeO 1.36, NiO 0.00, MnO 0.00, MgO 0.31, CaO 32.49, alk. n.d., $\text{H}_2\text{O} -$ 0.20, =100.05. The genesis of chromite deposits is discussed.

I. S.

- BAMBA (TAKEO). *Chromite deposits of Hokkaido: 1. Chromite deposits of the Hidaka-Iburi district.* Rept. Geol. Survey, Japan, 1957, no. 176, 64 pp., 43 figs., 14 pls., (Japanese with 4 pp. English summary).

Details of the deposits of the district, with many mine maps, are presented. Chromite deposits, serpentinites, and associated leucocratic rocks in the region are closely related to each other; the extreme contrasting characters among them are regarded as caused by complete differentiation of the parent magma.

A. P.

Uranium, &c.

- DEANS (T.). *A galena-wulfenite-uraniferous-asphaltite horizon in the Magnesian Limestone of Nottinghamshire.* Min. Mag., 1961, **32**, 705–715, 2 figs.

The top two inches of the Lower Magnesian Limestone is feebly mineralized along its outcrop in central England from Nottingham to Doncaster. The mineralization is predominantly of galena and lesser cerussite but in some areas includes uraniferous asphaltite containing 0.2 to 1% U_3O_8 .

Chemical analysis by R. Pickup of the inorganic constituents of asphaltite from Bulwell Pottery, Nottinghamshire, gave U_3O_8 0.89, PbO 3.90, $\text{Fe}_2\text{O}_3 + \text{Al}_2\text{O}_3$ 1.7, CaO 8.08, MgO 1.32%. Wulfenite occurs at Bulwell and Kirkby in Ashfield. The paragenesis and age of the minerals are discussed.

R. A. H.

- HORR (C. A.), MYERS (A. T.), & DUNTON (P. J.). *Uranium and other metals in crude oils: A. Methods of analysis for uranium and other metals in crude oils, with data on reliability.* Bull. U.S. Geol. Survey, 1961, **1100**, 1–17 tables.

The content of U and other metals in crude oils range from 0.1 to 100 p.p.m.

K. S.

- HYDEN (HAROLD J.). *Uranium and other metals in crude oils: B. Distribution of uranium and other metals in crude oils.* Bull. U.S. Geol. Survey, 1961, **1100**, 17–93 pls., 39 figs., 8 tables.

Crude oils can leach U from sandstone containing such minerals as uraninite and carnotite, hence the uranium content of crude oils may indicate the uranium content of sandstone oil reservoirs.

K. S.

- BELL (KENNETH G.). *Uranium and other trace elements in petroleum and rock asphalts.* Prof. Paper U.S. Geol. Survey, 1960, **356-B**, 45–65.

The average uranium content of crude oil is 1 p.p.m. There is no correlation between uranium content of crude oil and the geological age of the reservoir rock. There is no evidence that petroleum acts as an ore-forming fluid for uranium.

K. S.

- THOMSON (JAS. E.). *Uranium and thorium deposits at the base of the Huronian System in the District of Sudbury.* Geol. Rept. Ontario Dept. Mines, 1960, no. 1, 40 pp., 5 figs., 10 maps.

All available information on U and Th deposits of the conglomeratic type found in the district of Sudbury during 1953–58 is compiled, and 19 occurrences of radioactive conglomerate are described. In general, a pre-Huronian basement complex, consisting of volcanic, sedimentary, and granitic rocks, is overlain unconformably by a sedimentary Huronian group which includes basal radioactive quartz pebble conglomerate, with quartzite or argillite interbedded grading upwards into quartzite and arkose. The quartz pebble conglomerate contains well-rounded to subangular pebbles of quartz and chert in a gritty matrix with varying amounts of pyrite; the width of the U-bearing beds varies greatly and the U content varies from 0.01–0.10% U_3O_8 . Uraninite, uranotorite, monazite, 'brannerite', thucholite and pitchblende have been found in the conglomerate.

pyrtolite, ilmenite, titanite, magnetite, tourmaline, chro-
nite, zircon, garnet, and apatite occur in the matrix, which
also contains the radioactive minerals, often associated with
pyrite. Field evidence favours a sedimentary origin of the
mineralization. Assays for U_3O_8 , both chemical and
radiometric, are given with the descriptions of mining
properties.

J. A. M.

FISCHER (RICHARD P.). *Vanadium-uranium deposits of the
Rifle Creek area, Garfield County, Colorado*. Bull. U.S.
Geol. Survey, 1960, **1101**, 52 pp., 8 figs., 10 pls., 3
tables.

Primary vanadium minerals consist dominantly of
micaceous silicates with a small amount of montroseite.
Secondary vanadium minerals are sparse. The only
uranium minerals, tyuyamunite or carnotite and bayleyite,
are secondary.

K. S.

SHAWNE (DANIEL R.), ARCHIBOLD (NORBERT L.), & SIMMONS
(GEORGE C.). *Geology and uranium-vanadium deposits
of the Slick Rock district, San Miguel and Dolores
Counties, Colorado*. Econ. Geol., 1959, **54**, 395-415,
9 figs., 1 table.

It is concluded that ground water, heated and set into
circulation near the end of Cretaceous time by igneous
intrusions in the La Sal and other centres on the Colorado
Plateau, picked up elements from sedimentary rocks where
faulted and fractured, and redeposited them at solution
interfaces where accumulations of carbonaceous material
provided favourable chemical conditions for precipitation.

W. E. H.

BERGENDAHL (M. H.), DAVIS (R. E.), & IZETT (G. A.).
*Geology and mineral deposits of the Carlile quadrangle,
Crook County, Wyoming*. Bull. U.S. Geol. Survey,
1961, **1082-J**, 613-706, 7 figs., 6 pls., 4 tables.

Carnotite and tyuyamunite occur in sandstone of the
Lakota formation (early Cretaceous). The ore also contains
unidentified black V minerals (haggite, for which the Carlile
mine is the type locality, and Phase B = 'protodoloresite')
[A.M. 45-1144], hewettite, and possibly coffinite. Fine-
grained calcite and gypsum fill interstices in mineralized
sandstone. Se and As are more abundant in specimens
which contain U.

K. S.

ARCHIBOLD (N. L.). *Relationships of carbonate cement to
lithology and vanadium-uranium deposits in the
Morrison formation in south-western Colorado*. Econ.
Geol., 1959, **54**, 666-682, 12 figs.

Sandstone from the top, ore-bearing unit of the Salt
Wash member of the Morrison formation contains an
average of 2.5 to 3.0% carbonate regardless of epigenetic

alteration, mineralization, or weathering. The lower,
generally barren sandstone lenses of the member contain
several times more carbonate. Altered mudstone contains
slightly less carbonate than unaltered mudstone. Carbonate-
rich zones adjacent to contacts with mudstone are probably
syngenetic, or early diagenetic, whereas carbonate-rich
zones which are closely associated in space with ore-bodies
may be genetically related to ore-deposits.

L. G. B.

HUTCHINSON (R. W.). *Geology of the Montgry pegmatite*.
Econ. Geol., 1959, **54**, 1525-1542, 7 figs.

A pegmatite at Bernic Lake, southeastern Manitoba,
exhibits a related complexity of structure and mineral
assemblages; perthite-plagioclase-quartz-muscovite,
cleavelandite-lithia micas-quartz, quartz-amblygonite,
albite, lepidolite, pollucite, and quartz assemblages. The
pegmatite was emplaced as a fluid; crystallization and
differentiation followed. Alteration of the amphibolitic
host rocks is minor. Late solutions resulted in the formation
of pollucite, lepidolite, and albite assemblages in the
interior of the pegmatite, probably by replacement of
earlier units of the pegmatite.

W. E. H.

Non-metallic & regional

KAWANO (YOSHINORI) & UEMURA (FUJIO). *Geology of the
Matsuo-Hachimantai sulphur deposits district, Iwate
Prefecture*. Rept. Geol. Survey, Japan, 1954, no. 158,
13 pp., (Japanese with English summary), geological
map with legend in Japanese and English.

A. P.

SMITH (JAMES WILLIAM). *Talc, soapstone, and related stone
deposits of Virginia*. Virginia Minerals, 1961, **7**, no. 2,
1-8, 13 figs.

This general review of the soapstone industry of Virginia
briefly outlines the active and abandoned quarries occurring
in at least ten counties in the State. The geology and
petrology of the rock, as well as its quarrying, milling, and
uses are given. A geological map of the principal area of
production is included.

R. S. M.

STEVEN (THOMAS A.). *Geology and fluor spar deposits,
Northgate district, Colorado*. Bull. U.S. Geol. Survey,
1960, **1082-F**, 323-422, 9 figs., 6 pls., 2 tables.

The deposits, among the largest in Western United
States, occupy late Tertiary (?) faults on the west flank of
the Medicine Bow Mountains. Geological relations indicate
near-surface deposition from dilute hydrothermal solutions.

K. S.

CONLEY (R. F.) & BUNDY (W. M.). *Mechanism of gypsifi-
cation*. Geochim. Cosmochim. Acta, 1959, **15**, 57-72,
9 figs.

Hydration of anhydrite is primarily due to the action of activating ions in ground water, very dilute activator solutions accelerating hydration more efficiently than pure water. Gypsification of anhydrite is effected by surface ionic transfer via transient activation complexes into which both anion and cation enter, alkali sulphates being the most effective activators. Primary precipitation of anhydrite from sea water is improbable. [M.A. 7-475, 8-87, 11-110]

R. C.

BENTOR (Y. K.) & VROMAN (A.). *The geological map of Israel on a 1:100,000 scale. Series A—Sheet 16: Mount Sdom.* (2nd edition), 1960, 117 pp., 16 figs., 33 pls., maps, & sections, 24 tables.

The chapter on economic geology (pp. 99-112) includes discussion of Dead Sea minerals, saline springs, rock salt, anhydrite, gypsum, asphalt, oil, oil shale, clays, sands, and phosphate deposits, with chemical analyses of clays, oil shale, and phosphates. The total salt content of the Dead Sea is $44,942 \times 10^6$ tons, made up of $23,000 \times 10^6$ tons $MgCl_2$, $12,650 \times 10^6$ tons $NaCl$, $6,125 \times 10^6$ tons $CaCl_2$, $2,050 \times 10^6$ tons KCl , 975×10^6 tons $MgBr_2$, 105×10^6 tons $CaSO_4$, and 12×10^6 tons $RbCl$. In 1959 the production of KCl reached 109,000 tons, and of bromine 2,000 tons.

D. H. Y.

ESPENSHADE (GILBERT H.) & POTTER (DONALD B.). *Kyanite, sillimanite, and andalusite deposits of the southeastern states.* Prof. Paper U.S. Geol. Survey, 1960, 336, 121 pp., 58 figs., 11 pls., 12 tables.

Al_2SiO_5 minerals occur in (a) quartzose rocks, commonly associated with other high-alumina minerals such as alunite, chloritoid, corundum, diaspore, dumortierite, lazulite, pyrophyllite, staurolite, topaz, tourmaline, and white mica; (b) metamorphosed argillaceous rocks; (c) pegmatites and quartz veins; and (d) residual soils and placers. Kyanite and sillimanite in micaceous schists and gneisses were formed by the metamorphism of aluminous sedimentary rocks; quartzose deposits of Al_2SiO_5 minerals seem to have been formed by metamorphism of aluminous sedimentary rocks and by hydrothermal activity. Chemical and spectrochemical analyses are given for 15 rocks and for

paragonite and muscovite (by Lucille M. Kehl) from Hager Mountain, Person County, North Carolina: respectively, SiO_2 46.78, 46.55, Al_2O_3 38.99, 36.97, Fe_2O_3 0.44, 0.74, FeO 0.01, 0.10, MgO 0.00, 0.15, CaO 0.12, 0.00, Na_2O 5.10, 1.90, K_2O 3.05, 8.33, H_2O+ 4.80, 4.28, H_2O- 0.14, 0.06, TiO_2 0.11, 0.36, CO_2 0.01, 0.04, P_2O_5 0.09, 0.06, F 0.05, 0.06, MnO 0.00, 0.00, BaO 0.07, 0.19, less $O=F$ 0.02, 0.03 = 99.74, 99.76. The optical properties are: paragonite α 1.572, β 1.595, γ 1.602, $2V_\alpha$ 38° , $\gamma-\alpha$ 0.30; muscovite α 1.570, β 1.593, γ 1.599, $2V_\alpha$ 36° , $\gamma-\alpha$ 0.029. The metamorphic rocks occupy the Blue Ridge and Piedmont provinces that extend for nearly 700 miles from Virginia to central Alabama.

K. S.

HEWITT (D. F.). *Nepheline syenite deposits of southern Ontario.* Ann. Rept. Ontario Dept. Mines, 1961, 69 Pt. 8, 1-194, 59 figs., 7 maps.

The economic development of nepheline syenite deposits in Ontario is described, and their chemical and mineralogical composition, industrial specifications and uses, and milling are discussed. Detailed geological, mineralogical, and petrographical studies of deposits in southern Ontario follow, and include Haliburton-Bancroft, Methuen Township (Blue Mountain), and Bigwood Township (French River) areas. Chemical analyses, both complete and partial, calculated norms, modal and Rosiwal analyses, and variation diagrams are included. Minerals associated with these deposits are plagioclase, amphibole, pyroxene, biotite, garnet, titanite, corundum, scapolite, calcite, magnetite, and graphite. Some nepheline rocks have been destroyed by metasomatism, marked by increase in SiO_2 and K_2O and decrease in Al_2O_3 and Na_2O ; the nepheline is replaced by feldspar and the excess Al_2O_3 may form corundum.

J. A. M.

KING (PHILIP B.) & FERGUSON (HERMAN W.). *Geology of northeasternmost Tennessee.* Prof. Paper U.S. Geol. Survey, 1960, 311, 136 pp., 27 figs., 19 pls.

Iron, manganese, and bauxite have been mined. The region has been prospected for phosphate, zinc, pyrite, baryte, and tripoli.

K. S.

EXPERIMENTAL MINERALOGY

ROY (R.) & COHEN (H. M.). *Effects of high pressure on glass: a possible piezometer for the 100 kilobar region.* Nature, 1961, 1960, 789-799, 1 fig.

The density of silica glass increases continuously as a function of both temperature and pressure. The high density product formed is stable over long periods and hence may be used as a piezometer. Silica glass (normal refr. ind.

of 1.458) when subjected to 150 kilobars pressure at 25° has a refr. ind. of 1.54.

M. J. Le F.

RELLY (B. H.). *A method for determining solubility at high temperatures and pressures.* Econ. Geol., 1959, 54, 1496-1505, 2 figs.

The method involves 'tagging' ZnS with ^{65}Zn and di-

solving the sulfide with water at a pressure of about 4500 lbs/in² and $130 \pm 5^\circ\text{C}$ in a bomb. The gamma-radiation intensity of the dissolved ZnS was measured by a scintillation counter. By use of a standardization curve the solubility of ZnS was determined to be 0.004 ± 0.001 gm/litre. The accuracy of this method is not fully established.

J. T. W.

SELM (PIERRE) & CROISSANT (ODILE). *Etude par diffraction électronique localisée de cristaux de cassitérite et de stannate de calcium et de leur dissociation sous l'effet du bombardement électronique*. C.R. Acad. Sci., Paris, 1960, **251**, 564–566.

E. J. & A. S.

LEJUS (ANNE-MARIE) & COLLONGUES (ROBERT). *Sur la formation d'une phase intermédiaire métastable au cours de la décomposition d'un spinelle non stoechiométrique*. C.R. Acad. Sci., Paris, 1960, **251**, 952–961.

A metastable monoclinic phase is formed between 900° and 1050°C .

E. J. & A. S.

PROUVOST (J.). *Transformations expérimentales des sulfures métalliques naturels, étude de leur mécanisme*. Bull. Soc. franç. Min. Crist., 1960, **83**, 265–294, 21 figs.

The study of the textures of the sulphide minerals by reflected light allows the history of metalliferous formations to be traced and suggests the possibility of the replacement of one metal by another. The observed natural textural features have been reproduced artificially by heating and by electrolysis, and the variations in reflectivity have been carefully examined. Minerals investigated include pyrite, marcasite, chalcopyrite, bornite, galena, millerite, chalcocite, and covellite. Replacement textures occurring in sulphiferous deposits all over the world are interpreted as resulting from raised temperatures; electrolytic action is also indicated in certain examples. [M.A. 10-343]

R. A. H.

KULLERUD (G.) & YODER (H. S.). *Pyrite stability relations in the Fe-S system*. Econ. Geol., 1959, **54**, 533–572, 12 figs., 13 tables.

The univariant equilibrium curve for the reaction pyrite \rightleftharpoons pyrrhotine and liquid (or gas) originates at an invariant point 743°C and about 10 bars, and passes through the points 748°C and 335 bars, 755°C & 1000 bars, 770°C & 200 bars, and 810°C & 5000 bars. Sealed collapsible gold tubes in which the pressure on the sample is that applied through the malleable metal wall by a gas or liquid were used in the range 300°C – 900°C . Small changes in the partial pressure of S below 10 bars markedly affect the upper stability of pyrite. The stability limits for pyrite compared

with the melting curves for common rocks in the presence of water provide a tentative explanation for the occurrence of primary pyrite in granites, gabbros, and amphibolite and for its absence in rhyolites and basalts. The presence or absence of pyrrhotine in a pyrite-bearing assemblage appears to be a function of bulk composition and not of temperature. The phase diagrams further indicate that at depths normally assumed for its deposition pyrite could form as a primary phase on the liquidus only in magmas of almost pure sulphur.

W. E. H.

SCHMAL (N. G.), FRISCH (B.), & HARGARTER (E.). *Zur Kenntnis der Phasenverhältnisse im System Fe-Ti-O bei 1000°C* . Zeits. anorg. Chem., 1960, **305**, 40–54, 11 figs.

The Fe-Ti-O system was investigated by means of CO_2 -CO equilibria, the isothermal phase diagram for 1000°C being determined by isothermal decomposition of Fe_2O_3 - TiO_2 mixtures. Below the FeO- TiO_2 join the compounds Fe_2TiO_4 and FeTiO_3 occur; above this line complete miscibility was found for Fe_3O_4 - Fe_2TiO_4 and Fe_2O_3 - FeTiO_3 compositions, and incomplete miscibility between Fe_3O_4 and FeTiO_3 . There is an ideal miscibility between Fe_3O_4 and Fe_2TiO_4 .

R. A. H.

GOLDSMITH (JULIAN R.) & HEARD (HUGH C.). *Subsolidus phase relations in the system CaCO_3 - MgCO_3* . Journ. Geol., 1961, **69**, 45–74, 11 figs., 3 pls.

Solid solution and disorder relations of the system were studied in the range 700° to 1200°C with the aid of a special sealed tube in an internally heated, externally cooled vessel, permitting pressures up to 10 kilobars in order to prevent decomposition. $\text{CaMg}(\text{CO}_3)_2$ is appreciably soluble in CaCO_3 , and the apex of the solvus lies at about $\text{Ca}_{57}\text{Mg}_{43}$ and 1075°C ; above this temperature the two are completely soluble in each other. The solubility of MgCO_3 in $\text{CaMg}(\text{CO}_3)_2$ amounts only to about 5% at 1100°C and that of $\text{CaMg}(\text{CO}_3)_2$ in MgCO_3 is not much greater. Cation disordering in pure $\text{CaMg}(\text{CO}_3)_2$ involves both point and layer disordering and becomes complete at 1200°C , above which the substance has a calcite-type structure. In natural dolomite, disordering may become complete at lower temperatures, due perhaps to impurities. An appendix treats P_{CO_2} - T relations.

R. E. W.

ARNTSON (R. W.), DICKSON (F. W.), & TUNELL (GEORGE). *Systems S - Na_2O - H_2O and S - H_2O . Application to the mode of origin of natural alkaline polysulfide and thio-sulfate solutions*. Amer. Journ. Sci., 1960, **258**, 574–582, 1 fig., 4 tables.

The saturation concentrations of sulphur in aqueous NaOH solutions containing excess orthorhombic sulphur

were studied at $T=25^{\circ}\text{C}$, $P=1$ atm. Analysis of solutions showed that sulphur reacts with aqueous NaOH to form sodium sulphide and thiosulphate; the polysulphide complex ion S_x^{2-} , where $x\approx 5$, forms in the presence of excess sulphur. It is postulated that natural alkaline solutions would also react with elemental sulphur to produce sulphide, thiosulphate, or polysulphide ions, which could form complex ions with certain metallic sulphides and transport them in solution to loci of deposition. J. A. S.

GARRELS (R. M.), THOMPSON (M. E.), & SIEVER (R.). *Control of carbonate solubility by carbonate complexes*. Amer. Journ. Sci., 1961, **259**, 24-45, 8 figs., 3 tables.

Activity coefficients of HCO_3^- and CO_3^{2-} were determined in NaCl, MgCl_2 , and NaCl- MgCl_2 solutions over a wide range of ionic strength. Marked differences in the activity coefficients obtained at the same ionic strengths in the various solutions are attributed to formation of complexes of Na^+ and Mg^{2+} with HCO_3^- and CO_3^{2-} . The dissociation constants of complexes formed by interaction of Na^+ and Mg^{2+} with CO_3^{2-} were determined. These interactions, and the relative stability of the MgCO_3 ion pair, have a marked effect on the solubility of carbonate minerals, and exert important controls on the total dissolved carbonate in sea water. If NaCl were substituted for MgCl_2 in the ocean, the total concentration of CO_3^{2-} would diminish to 20% of its present value, and total HCO_3^- would decrease to 80%. From the activity of Ca^{2+} it is shown that sea water is apparently supersaturated with respect to calcite ($\approx 300\%$). A high Ca^{2+} concentration may assist in explaining solution and cementation effects in subsurface waters. J. A. S.

[OSTROVSKIĬ (I. A.), MISHINA (G. P.), & POVILAITIS (V. M.)] Островский (И. А.), Мишина (Г. П.) и Повилайтис (В. М.). P-T Проекция системы кремнезем-вода [*P-T projection of the system silica-water*]. Доклады Акад. Наук СССР [C.R. Acad. Sci. U.S.S.R.], 1959, **126**, 645-646.

A new PT diagram for the $\text{SiO}_2\text{-H}_2\text{O}$ system is given (P up to 4000 kg/cm^2) and the observed phase relationships are compared with theoretical predictions. The results differ from previous data [e.g., M.A. 12-615]; quartz at high pressures can coexist with liquid even above 1300° , but neither tridymite nor cristobalite are stable at high pressures. G. R.

[КОМКОВ (А. И.)] Комков (А. И.). Рентгеновское исследование искусственных редкоземельных соединений типа TRNbO_4 [*An X-ray study of synthetic rare-earth compounds of RENbO_4 type*]. Доклады Акад. Наук СССР [C.R. Acad. Sci. U.S.S.R.], 1959, **126**, 853-854.

Cell parameters a , b , c , and β are given for the synthetic compounds with $M = \text{La, Ce, Pr, Nd, Sm, Gd, Dy, Er, and}$

Yb. All belong to one series having a distorted scheelite type structure (space group $I2$), identical with that shown by fergusonite after ignition [M.A. 14-53]. When heated they undergo a reversible 'displacive' [M.A. 10-380] transition to a tetragonal structure. G. R.

[КОМКОВ (А. И.)] Комков (А. И.). О минералах серии евксеним-поликраз и приорит-бломстрандина. [C.R. Acad. Sci. U.S.S.R.], 1959, **126**, 641-644.

Indexed powder spacings are tabulated for synthetic euxenite (YNbTiO_6), synthetic aeschynite (CeNbTiO_6), and an analysed blomstrandine ignited at 580° ; the structures are discussed. The data can be used for distinguishing between members of the euxenite-polycrase and priorite-aeschynite-bloomstrandine series. [M.A. 14-274] G. R.

BRINDLEY (G. W.) & DE KIMPE (C.). *Attempted low temperature syntheses of kaolin minerals*. Nature, 1961, **190**, 254, 1 fig.

Beginning with gibbsite and silica (either as gel or in solution as ethyl silicate) in sealed glass tubes at 150°C under 5 atm. water-vapour pressure and agitated for 1-3 weeks, a kaolin mineral replaces the gibbsite when the pH remains below 1.5. In the absence of silica and under the above conditions, gibbsite is transformed to boehmite [M.A. 14-247] M. J. LE B.

GUTT (W.). *A new calcium magnesiosilicate*. Nature, 1961, **190**, 339-340.

Ignition at 1250°C of a finely ground mixture of SiO_2 , CaCO_3 and MgO for 10 days gave a new compound of approximate composition $(2\text{CaO}, \text{SiO}_2)_{5.6} (3\text{CaO}, \text{MgO}, 2\text{SiO}_2)_{4.4}$. It melts incongruently. In sodium light, α 1.711, γ 1.725, $2V_{\gamma} \approx 30^{\circ}$ sp. gr. 3.30. X-ray powder data are given: strongest reflections occur at 2.732 (10), 2.718 (10), and 2.668 (8) Å. M. J. LE B.

STRUNZ (H.), FREIGANG (H.), & CONTAG (B.). *Germanat mit Apatit- und Granatstruktur*. Neues Jahrb. Min. Monatshefte, 1960, 47-48.

Cell parameters are listed for various chlorine-bearing calcium-cerium germanates with the apatite structure and for germanates of Ca, Cd, Mn in combination with Al, Ga, Cr, and Fe^{3+} , with the garnet structure. R. A. H.

STRUNZ (H.) & JACOB (P.). *Germanat mit Phenakit- und Olivinstruktur*. Neues Jahrb. Min., Monatshefte, 1960, 78-79.

Cell parameters are listed for synthetic LiAl and LiGa germanates with phenakite structure and for CaMg, Ca, Sr

and Ba germanates with olivine structure, and also for $\text{Ba}_3\text{V}^{3+}(\text{GeO}_4)_3$ (garnet), $\text{Bi}_4(\text{GeO}_4)_3$ (germanate-eulytine), LiCrGeO_4 (spinel), and LiCrTiO_4 . R. A. H.

TRUNZ (H.) & RITTER (EDITH). *Germanate mit Tektonisch-silicat-Struktur*. Neues Jahrb. Min., Monatshefte, 1961, 22-24.

The synthetic production of Ge-nepheline, -celsian, -sodalite, -leucite, -natrolite, and -analcite is reported and their specific gravity and cell parameters are tabulated. [M.A. 11-326] R. A. H.

WHITE (J. L.), BAILEY (G. W.), BROWN (C. B.), & ALRICH (J. L.). *Infrared investigation of the migration of lithium ions into empty octahedral sites in muscovite and montmorillonite*. Nature, 1961, 190, 342, 1 fig.

The migration was effected using molten lithium nitrate at 300°C for 480 hours. [M.A. 14-176] M. J. LE B.

ANIKIN (I. N.). *Hydrothermal synthesis of scheelite*. Soviet Physics: Crystallography, 1957, 2, 191-192, 1 fig. Translated from Kristallografiya, 1957, no. 1, 195-197.

Clear, faceted crystals up to 0.5 mm were produced in an autoclave in which CaWO_4 in 4% aqueous solution of NaOH was cooled from an initial temp. of 380°C and pressure of 300 atm. [M.A. 14-37] A. P.

MIYAMA (TOSHIMICHI). *Existence of indialite solid solutions*. Proc. Japan Acad., 1955, 31, 166-168, 2 figs., 1 table.

Mix crystals of magnesium indialite [M.A. 12-513], $\text{Im}(\text{Mg}_2\text{Al}_4\text{Si}_5\text{O}_{18})$ and magnesium beryl, $\text{Bm}(\text{Mg}_3\text{Al}_2\text{Si}_6\text{O}_{18})$ have been prepared at 20 mol % intervals by devitrification of glasses of appropriate composition. Homogeneous mix crystals were obtained from all preparations except Bm_{100} . Cell dimensions range from a 9.777 Å, c 9.358 for Im_{100} to a 9.758, c 9.344 for Bm_{80} . A. P.

TAYLOR (H. F. W.) & HARRISON (J. W.). *Relationship between calcium silicates and clay minerals*. Clay Min. Bull., 1956, 3, 98-111, 2 figs.

The crystal-chemical basis of the relationship between hydrated calcium silicates and clay minerals is discussed. New data are given for the refractive indices, specific gravities, basal spacings, and dehydration isobars of synthetic tobermorites, and a tentative structural explanation is proposed for the variability of the Ca:Si ratio in these materials. R. A. H.

PEDRO (GEORGES). *Altération expérimentale des roches par l'eau sous atmosphère de CO_2* . C.R. Acad. Sci., Paris, 1960, 250, 2035-2037.

A biotite-granite and an olivine-basalt, broken down to fragments 2-5 mm in size, were tested in a solution of CO_2

kept at pH 4 and at 60-70°C. After treatment with 1000 litres of solution green sediments (amounting to 1.2% and 3.5% of the original granite and basalt) were separated, and found to be composed of 24.8% calcite, 36.2 montmorillonitic clay mineral, 39.0 aluminosilicate (from granite) and 22.5% calcite + aragonite, 39.5 montmorillonitic clay mineral, and 38.0 aluminosilicate (from basalt). E. J. & A. S.

CHENEBAUX (JACQUES), BORDET (PIERRE), & SABATIER (GERMAIN). *Sur les conditions de formation des obsidiennes et des rétinites*. C.R. Acad. Sci., Paris, 1960, 250, 1679-1680.

Production of a pitchstone from an obsidian by heating under high water-vapour pressure and of an obsidian from a pitchstone by heat and dehydration are reported. Sudden chilling under great pressure allows the pitchstone to retain high-temp. water. When cooling in free air is slow, magma, degassed and dehydrated, produces obsidian.

E. J. & A. S.

KITANO (YASUSHI) & KAWASAKI (NOBUKO). *Behaviour of strontium ion in the process of calcium carbonate separation from bicarbonate solution*. Journ. Earth Sci. Nagoya Univ., 1958, 6, 63-74, 7 tables.

With increase of Sr concentration the percentage of aragonite formed increases to a maximum and decreases at higher Sr concentrations. The presence of Sr favours aragonite when the solution is not agitated. The amount of entrapped Sr in the separated CaCO_3 is close to the molar ratio 0.003 Sr/Ca through a wide range of concentration of Sr in the original bicarbonate solution. A. P.

HOLSER (WILLIAM T.) & SCHNEER (CECIL J.). *Hydrothermal magnetite*. Bull. Geol. Soc. America, 1961, 72, 369-386, 2 figs., 1 pl.

The solubility of magnetite was measured in dilute aqueous solutions of HCl at high temperature and pressure. At 390°C, 440 bars, in 0.0002 M HCl, 300 p.p.m. ferrous iron is dissolved. Solubility decreases with acid concentration: in pure water under the same conditions, solubility is less than 0.02 p.p.m. Calculation of real-gas equilibria from thermodynamic data shows that the contribution of volatile Fe_2Cl_6 molecules is insignificant in such dilute solutions. Comparison with room-temperature data suggests that ferrous iron is brought into true solution mainly as Fe^{2+} ion, by reaction with H^+ , although complexes such as FeCl^{2+} and FeOH^{2+} may participate. Magnetite was synthesized by reaction of acidic iron chloride solutions with calcite at high temperature and pressure. The amount of iron measured in solutions with HCl concentrations less than a hundredth of that of natural fluids is great enough to be geologically significant.

A. L. A.

GEMSTONES

FUTERGENDLER (S. I.). *X-ray study of solid inclusions in diamonds*. Soviet Physics : Crystallography, 1958, **3**, 494-497, 7 figs., 2 tables. Translated from Kristallografiya, 1958, **3**(4), 494-496.

Garnet, olivine, diopside, chrome spinel, and diamond have been identified by X-rays as inclusions in diamonds. The source of the material examined is not disclosed. [M.A. **12**-166 ; **14**-121, 488] A. P.

[VLASOV (K. A.) & KUTUKOVA (E. I.)] Власов (К. А.) и Кутукова (Е. И.). Изумрудные копи [*Emerald mines*]. Изд. Акад. Наук СССР [Publ. Acad. Sci. U.S.S.R.], 1960, 250 pp., 118 figs. Price 16r. 45k.

This volume contains a detailed description of rocks and minerals found in the region of the so-called 'Emerald mines' of the Middle Urals, situated on the eastern slope of the watershed ridge in the region between Sverdlovsk and Chelyabinsk. Emerald, beryl, and other precious and semi-precious minerals occur in hybrid pegmatites formed through the interaction of granite-pegmatite magma on the basic and ultrabasic rocks adjoining Murzinka granite intrusion. This interaction resulted in the de-silicification of the pegmatites and in their enrichment in basic oxides. A detailed account is given of eighty minerals containing some sixty chemical elements. The description of the minerals is accompanied by a large number of chemical and spectroscopic analyses, as well as by numerous X-ray, optical, and thermal data. The paragenesis of minerals of the pure granite pegmatites and of the hybrid granite pegmatites, the geochemistry of the deposits, and the genesis of the Uralian emerald occurrences, are discussed in great detail.

S. I. T.

EPPLER (W. F.). *Growth marks in emerald*. Journ. Gem-mology, 1961, **8**, 72-77, 12 figs.

Significant marks of growth detected in emeralds include straight growth layers following preferred crystal planes, splinters of pre-existing emerald crystals as heterogeneous inclusions, three-phase inclusions in the form of tubes parallel to the *c* axis, other three-phase inclusions characterizing healing fissures, and crystals of calcite or partially dissolved petalite. [M.A. **14**-489] R. A. H.

FORD (R. A.) & HILL (O. F.). *The absorption spectrum of chromium in the spinel structure*. Spectrochim. Acta, 1960, **16**, 1318-1321, 1 fig.

The absorption spectrum of Cr^{3+} in magnesium spinel has been studied at room temperature and at 100° K in the

region 14,000 to 35,000 cm^{-1} . The observed transitions are comparable with those of ruby. The presence of a large trigonal field at the Cr^{3+} site in spinel is confirmed.

R. A. H.

ZWAAN (P. C.). *Some notes on the identification of the pyrope-almandine garnets*. Proc. Kon. Ned. Akad. van Wetenschappen, 1961, ser. B., **64**, 305-312, 2 figs., 3 tables.

It is possible to identify a garnet in the pyrope-almandine series by X-ray powder photographs. The intensity of some diffraction lines and the size of the unit cell are taken into account. From a gemmological point of view, however, measurement of physical properties is the best way to determine a garnet, the absorption spectrum being very important.

C. J. O.

TSINOBER (L. I.) & CHENTSOVA (L. G.). *Synthetic amethyst quartz*. Soviet Physics : Crystallography, 1960, **4**, 593-595, 2 figs. Translated from Kristallografiya 1959, **4**(4), 633-635.

Quartz grown in steel autoclaves contains iron. More Fe enters the quartz grown from K_2CO_3 solutions than from Na_2CO_3 solutions. Absorption curves are pictured for several types of natural and synthetic quartz crystals.

A. P.

ANSTEY (ROBERT L., II). *Youngite, a new gem material from Wyoming*. Rocks and Minerals, 1961, **36**, 242-243, 2 figs.

Youngite is a local name for quartzite which occurs at Lake Guernsey, near Wendover, Platte County, Wyoming. The quartzite, belonging to the Opeche formation (Pennsylvanian), is popular with amateur lapidaries because sawed slabs frequently show delicate lace-like patterns of pink and white with agate-type fortifications around small vugs of drusy quartz crystals. It also exhibits a light-green fluorescence under short-wave ultraviolet radiation. The rock is named for Mr. R. H. Young, a local rancher.

R. S. M.

HOMES (R. J.). *Synthetic and other man-made gems*. Footprints, 1960, **32**, 3-25.

Following a discussion on the nature of gems and their identification, details are given of imitations, assembled and reconstructed stones, the Verneuil flame-fusion process and the production of synthetic corundum and spinel and their identification.

R. A. H.

GEOCHEMISTRY

WEYL (P. K.). *The carbonate saturoimeter*. Journ. Geol., 1961, **69**, 32–44, 8 figs.

The degree of saturation of a solution, such as sea water, in respect to a particular carbonate is measurable in terms of potential change when the finely divided solid carbonate is placed next to the pH-sensitive electrode. No chemical analysis of the solution is required. R. E. W.

VINOGRADOV (A. P.) [Виноградов (А. П.)]. *Химическая эволюция земли* [*The chemical evolution of the Earth*]. Чтения им. В. И. Вернадского [V. I. Vernadsky's Lecture]. Изд. Акад. Наук СССР [Publ. Acad. Sci. U.S.S.R.], 1959, 44 pp., 2 figs. Price 1r. 85k.

Detailed study of the chemical composition of the geospheres, migration and distribution of various elements, and considerations drawn from the fields of astronomy and thermodynamics suggest to the author that the Earth was probably formed in a 'cold' state from material close to the average composition of meteorites. The gradual development of radiogenic heat in the growing planet lead to selective melting and degassing of the earth's mantle and to the accumulation of certain elements on the outer part of the Earth with a consequent formation of a crust of basalt and granite. In this way the outer geozones became enriched in certain elements and the crust developed its magmatic activity. A process, similar to that called in metallurgy 'zone refining', together with the process of 'degassing' led to accumulation in the outer geozones of the most fusible, most volatile, and most reaction-prone elements. On the other hand the residual product of such processes was a rock near dunite in composition, which forms the present mantle, a rock enriched in 'refractory' elements. 'In this way the chemical evolution of the Earth is sustained and regulated by a powerful and continuous process of radial selective melting and degassification of the material of the mantle, as a result of a self-caused decay of the weak radioactive atoms, while the intensity of this process is determined by the size of the planet'.

S. I. T.

TUREKIAN (KARL K.) & WEDEPOHL (KARL HANS). *Distribution of the elements in some major units of the earth's crust*. Bull. Geol. Soc. America, 1961, **72**, 175–192.

This paper presents a table of abundances of the elements in the various major units of the Earth's lithic crust with a documentation of the sources and a discussion of the choice of units and data. A. L. A.

TAYLOR (S. R.). *The abundance of the rare earth elements in relation to their origin*. Geochim. Cosmochim. Acta, 1960, **19**, 100–112, 4 figs.

The relative abundances and apparent regularities of the rare earths are examined in relation to the different processes of nucleogenesis of the rare earth nuclides given by Burbidge et al. (1957). In adjusting the data of Minami (1935), Suess and Urey (1956) have decreased the abundances of the *s*-process nuclides and increased the abundances of the *r*-process nuclides. The abundances of Cameron (1959) further this trend. His Ce/Nd ratio of 0.658 necessitates major fractionation between the chondrites and earth.

R. C.

MASUDA (AKIMASA). *Simple regularity in the variation of relative abundances of rare earth elements*. Journ. Earth Sci. Nagoya Univ., 1957, **5**, 125–134, 6 figs., 2 tables.

Numerical relations among the abundances of the rare earth elements are determined from the data of Vainshtein et al. [M.A. **13**–620–621]. It is found that correlation formulas of the type $E_m = AE_l + BE_n$ hold among the amounts of lanthanide elements with atomic numbers $l < m < n$. A. P.

WLOTZKA (F.). *Untersuchungen zur Geochemie des Stickstoffs*. Geochim. Cosmochim. Acta, 1961, **24**, 106–154, 10 figs.

From an investigation of 401 rock and mineral samples it is concluded that nearly all magmatic rocks contain NH_3 nitrogen, ranging between 5 and 50 p.p.m., of which approximately half is water-soluble: NO_3 nitrogen was not found. Muscovite and biotite are rich in NH_3 -N (average 60 and 33 p.p.m. respectively), feldspars contain less (20 p.p.m.), and quartz least (13 p.p.m.). Late magmatic minerals such as zeolites are higher in NH_3 -N than the rocks in which they occur. The NH_3 -N content of sedimentary rocks is higher than that in magmatic rocks: clays and clay-slates 580 p.p.m., sandstones 135 p.p.m., and limestones 70 p.p.m. NO_3 -N amounts to only 5 to 20 p.p.m. in certain surface sediments. Metamorphic rocks are low in NH_3 -N, with an average of 47 p.p.m. Two methods for the determination of combined nitrogen in rocks and minerals are described. R. A. H.

MORRIS (D. F. C.) & KILLICK (R. A.). *Silver and thallium contents of rocks*. Geochim. Cosmochim. Acta, 1960, **19**, 139–140.

Ag and Tl have been determined by neutron activation analysis in standard granite G-1 (Ag 0.042 p.p.m., Tl 1.3 p.p.m.), standard diabase W-1 (Ag 0.057 p.p.m., Tl 0.17 p.p.m.), and five rocks (peridotites, gabbros, syenite) of the Inch intrusion, Aberdeenshire, Scotland. [M.A. **15**–83] R. C.

BROOKS (R. R.). *Apparent geochemical association of bismuth and thallium*. Nature, 1961, **189**, 910-911, 1 fig.

It is suggested that one atom each of bismuth and thallium replace two atoms of lead. This would explain the apparent coherence between bismuth and thallium.

M. J. LE B.

MORITA (YOSHIMI). *Distribution of copper and zinc in various phases of the earth materials*. Journ. Earth Sci. Nagoya Univ., 1955, **3**, 33-57, 3 figs., 14 tables.

The concentration of Cu and Zn in 92 samples of igneous rocks of all types from Japan and in 3 composite samples of shale has been determined. For the abundance in the earth's crust 40 p.p.m. Cu and 80 p.p.m. Zn are given as most probable. The Cu and Zn content of numerous spring, lake, and river waters has also been determined. A. P.

[SHCHERBINA (V. V.).] Щербина (В. В.). Особенности геохимии скандия и типы его месторождений [*Geochemistry of scandium and types of its deposits*]. Геология месторождений редких элементов. Вып. 8. [Geology of the deposits of rare elements. No. 8.] Всесоюз. Науч.-Иссл. Инст. Мин. Сырья [All-Union Sci. Res. Inst. Mineral Raw Materials], Moscow, 1960, 58 pp., 6 figs.

A concise resumé of the minerals and rocks containing scandium and of its geochemistry. An attempt is made to provide a genetic classification of ores containing scandium and to discuss its metallogeny.

S. I. T.

[GABINET (M. P.).] Габинет (М. П.). О радиоактивности битуминозных пород менилитовой серии [*Radioactivity of bituminous rocks of the menilite series*]. Проблемы геохимии. I. Изд. Львов Унив. [Problems of geochemistry. I. Publ. Lvov Univ.], 1959, pp. 256-260, (English summary, p. 312).

High radioactivity is shown by black argillites (organic carbon 4.07-16.23%), brown argillites (organic carbon 1.49-3.86%), and the bentonite tuff clays (organic carbon 0.20-0.65%). The high radioactivity is attributed to the presence of volcanic tuff and not to a high percentage of organic material.

S. I. T.

[SLIVKO (M. M.).] Сливко (М. М.). Редкие и рассеянные элементы в турмалинах [*Rare and disperse elements in tourmalines*]. Проблемы геохимии. I. Изд. Львов Унив. [Problems of geochemistry. I. Publ. Lvov Univ.], 1959, pp. 261-271, 4 figs., (English summary, pp. 312-313).

The forty-three chemical elements present in tourmalines are subdivided into basic, principal, secondary, and admixture elements. The geochemical characters of these

elements are discussed and on geochemical grounds iron-rich tourmalines are subdivided into schorlite-dravite and schorlite-elbaite[rubellite]-tsilaisite. [M.A. **15-210**]

S. I. T.

[LAZARENKO (E.).] Лазаренко (Э.). К геохимии теллура в измененных породах Закарпатья [*Geochemistry of tellurium in altered rocks of Transcarpathia*]. Проблемы геохимии. I. Изд. Львов Унив. [Problems of geochemistry. I. Publ. Lvov Univ.], 1959, pp. 272-279, 6 figs., (English summary, p. 313).

Lavas and tuffs of Vygorlat-Gutin range, greatly affected by hydrothermal alteration, are described. Among metasomatic rocks, such as quartz-tourmaline, quartz-dumortierite, quartz-topaz, quartz-fluorite, and others, various lead-zinc, mercury, and tellurium-bismuth ores are found. Wehrlite is found infilling fissures among dehydration polygons of a quartz-tourmaline rock.

S. I. T.

[DOLGOV (YU. A.).] Долгов (Ю. А.). Роль коллоидов в образовании кварца колчеданных месторождений Среднего Урала [*The role of colloids in the formation of quartz in the pyrite deposits of the Middle Urals*]. Проблемы геохимии. I. Изд. Львов Унив. [Problems of geochemistry. I. Publ. Lvov Univ.], 1959, pp. 280-295, 16 figs., 6 pls., (English summary p. 313).

Certain types of inclusions and veinlets in quartz are taken as criteria for assuming that the quartz found in pyrite deposits is of a colloidal origin.

S. I. T.

[UKLONSKIĬ (A. S.).] Уклонский (А. С.). Парагенезис минералов и параэлементы [*Paragenesis of minerals and paraelements*]. Доклады Акад. Наук УзССР [C.R. Acad. Sci. Uzbek S.S.R.], 1952, no. 3, 1-7.

— — Геохимическое Значение Параэлементов [*Geochemical significance of paraelements*]. Зап. Узб. Отд. Вс. Минер. Общ. [Mem. Uzbek. Sect. All-Union Mineral. Soc.], 1955, **8**, 13-25.

— — Изотонический парагенезис химических элементов [*Isotonic paragenesis of chemical elements*]. Доклады Акад. Наук УзССР [C.R. Acad. Sci. Uzbek S.S.R.], 1959, no. 5, 20-22.

— — — Изобары, изотоны устойчивых изотопов и их параэлементы [*Isobars, isotones of stable isotopes and their paraelements*]. Ibid., no. 11, 16-19.

In 1952 the author proposed the term 'paraelements' for the chemical elements normally found together in the crystalline lattice of minerals. Since then he has made an attempt to develop this concept, in particular in its application to the paragenesis of minerals, and to other problems in geochemistry.

S. I. T.

VERSHKOVSKAYA (O. V.), KRASNOVA (V. S.), & SALTŬKOVA (V. S.)] Вершковская (О. В.), Краснова (В. С.)' и Салтыкова (В. С.). Галлий. Методы исследований, распространение в горных породах и минералах, типы месторождений [*Gallium. Methods of study, distribution in rocks and minerals, types of deposits*]. Инст. мин., геох., крист. редких элементов [Inst. Min. Geochem. Cryst. Rare Elements], Moscow, 1960, pp. 3-136, 3 figs.

PERVUKHINA (A. E.)] Первухина (А. Е.). Краткие сведения по применению и экономике галлия в зарубежных странах. [*Brief information on the uses and economics of gallium abroad*]. Ibid., pp. 137-144.

IVANOV (V. V.), VOLGIN (V. YU.), KRASNOV (A. A.), & LIZUNOV (N. V.)] Иванов (В. В.), Волгин (В. Ю.), Краснов (А. А.) и Лизунов (Н. В.). Таллий. Основные черты геохимии и минералогии, генетические типы месторождений и геохимические провинции. [*Thallium. Main outlines of its geochemistry and mineralogy, genetic types of deposits and geochemical provinces*]. Инст. мин., геох., крист. редких элементов [Inst. Min. Geochem. Cryst. Rare Elements], Moscow, 1960, pp. 3-155, 9 figs.

These two booklets provides summaries of the present knowledge of the properties of gallium and thallium respectively, of their minerals and ores, their geochemistry, types of deposits, geochemical provinces, and prospecting and analytical methods. Bibliographies are provided.

S. I. T.

RUSHTON (B. J.). *Beryllium in Tanganyika granitic rocks*. Geochim. Cosmochim. Acta, 1960, **20**, 154-155.

Spectrographically detectable Be ($> \frac{1}{2}$ - 1 p.p.m.) occurs in 42 of 284 specimens of granite and granodiorite from 17 major granitic occurrences in Tanganyika. The amount of Be never exceeds 10 p.p.m. and is more frequent in the granites than in the granodiorites. [M.A. **12-33**, **13-117**, 274] R. C.

YAMASAKI (KAZUO), IIDA (CHUZO), & YOKIO (HAJIME). *A spectrographic determination of the distribution of trace elements in a granodiorite and its weathering products*. Journ. Earth Sci. Nagoya Univ., 1955, **3**, 58-64, 2 figs., 2 tables.

Granodiorite of Okazaki, Aichi Prefecture, and its weathering products were analyzed for major and minor constituents; their distribution in the weathering products is discussed. Iron content reached a maximum value in the course of weathering. Ba, Ce, La, Pr, and Sr decreased, while Cr and V increased. Ni and Zr showed maximum values in the same zone with iron. [Author's abstract] A. P.

WARREN (H. V.) & DELAVAUULT (R. E.). *Trace element variations in related rocks*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **2**, 57-64, 1 fig.

The variations in the Zn and Cu contents of various igneous rocks in southern British Columbia have been investigated, with particular reference to the presence or absence of mineralization. The results suggest that within the larger and more generally recognized geochemical provinces smaller but contrasting areas exist which may well represent the metamorphosed product of various facies of sedimentary rocks. R. A. H.

GADOMSKI (M.). *Rubidium, caesium and thallium in pegmatitic mica minerals*. Arch. Min., [Polska Akad. Nauk], 1958, **22**, 207-225, 2 figs., (Polish summary).

92 micas from pegmatites of the Sudeten region were studied. Concentration of Rb, Cs, Tl, and Li is not related to their average content within the whole mountain system. Although biotites from the Karkonosze [Riesengebirge] granites are richer in these elements than biotites from the Strzegom massif, lepidolites and lithium micas with high content of rare alkaline elements are developed in the Strzegom region because of specific physico-chemical conditions during the late, and post-magmatic stages of crystallization. The Rb/Tl ratio in biotites from granitic rocks is constant within each complex but varies in pegmatitic mics. The Rb/Tl ratio in lepidolites which replaced biotite towards the end of the pneumatolytic phase is several times higher than in primary lepidolites, while the Rb/Cs ratio is not affected by this secondary origin. In pegmatites containing one generation of micas the concentration of Rb, Cs, Tl, and Li is approximately constant. Two groups of micas are distinguished: (a) micas rich in Li (lepidolites) with high concentration of Rb, Cs, and Tl; (b) micas with low Li content (muscovites and biotites) containing much less Rb, Cs, and Tl than the minerals of group (a). Only under rare conditions may group (b) micas attain high concentration of these elements, as in muscovites from Orijärvi. [M.A. **14-456**] W. S.

FLEISCHER (M.). *The geochemistry of rhenium, with special reference to its occurrence in molybdenite*. Econ. Geol., 1959, **54**, 1406-1413, 4 tables.

Re⁴⁺ and Re⁷⁺ are the most stable states for rhenium. Re has a wide range of concentration in molybdenite, even in samples from a single deposit. No mineral other than molybdenite or wulfenite has been found to contain as much as 2 p.p.m. Re. The relation between rhenium content and geological conditions of formation has not been established. J. T. W.

SEN (SISIR K.). *Some aspects of the distribution of barium, strontium, iron and titanium in plagioclase feldspars*. Journ. Geol., 1960, **68**, 638-665, 9 figs.

Determination of the amounts of Ba, Sr, Fe, and Ti in the lattice of natural plagioclases is handicapped by difficulties in eliminating microscopic and submicroscopic impurities from the samples. These elements, as well as An- and Or-contents were inferred from spectrographic and flame photometric analyses of plagioclases separated in as pure a state as possible from 35 rocks of the amphibolite facies, 26 of the granulite facies, 14 volcanic rocks, and 1 granite. Analyses were also made of 14 bulk samples of the granulitic rocks. The elements in question in plagioclase generally increased from amphibolitic through granulitic to volcanic rocks, suggesting that temperature is a major factor in the amounts that can be accommodated in the plagioclase lattice. [M.A. 15-141] R. E. W.

HEINRICH (E. Wm.), BORUP (R. A.), & LEVINSON (A. A.). *Relationships between geology and composition of some pegmatitic monazites*. *Geochim. Cosmochim. Acta*, 1960, **19**, 222-231, 1 fig.

X-ray fluorescence spectrometer determinations of La, Ce, Pr, Nd, Sm, Gd, Y, and Th are given for 14 monazites from 10 pegmatites (replacement and magmatic) in New Mexico and Colorado, U.S.A. ThO_2 varies from 3.8 to 11.8 wt.%, and all the monazites have $\text{Nd} > \text{La}$; three have $\text{Sm} < \text{La}$ with $\text{La} + \text{Ce} + \text{Pr}$ atomic percentages as low as 51-55. Paragenetically identical monazites have rare-earth element distributions which are characteristic both of individual pegmatites and individual pegmatite districts. Data suggest the possibility of correlating pegmatites by the rare-earth element distribution of their monazites. [M.A. 11-304, 12-345, 13-619, 620] R. C.

STONHILL (L. G.). *The estimation of the oxidation state of pitchblende in ores*. *Geochim. Cosmochim. Acta*, 1960, **19**, 168-176.

The procedure described is appropriate where precise chemical methods fail. U oxides in the finely ground (<300 mesh) concentrate are converted to their fluorides under anhydrous conditions at the lowest possible temperature. U^{VI} and U^{IV} are estimated by extracting UO_2F_2 and UF_4 from the hydrofluorinated U oxides and determining U spectrophotometrically or fluorimetrically. U^{VI} , as UO_2F_2 , can be recovered from complex oxide mixtures with an accuracy of the order of $\pm 23\%$. The method should be applicable to other U minerals. R. C.

GARRELS (R. M.) & NAESER (C. R.). *Equilibrium distribution of dissolved sulphur species in water at 25°C and 1 atm total pressure*. *Geochim. Cosmochim. Acta*, 1959, **15**, 113-130, 19 figs.

A series of E_h -pH diagrams are given showing the distribution of dissolved sulphur and individual molecular

and ionic sulphur species in equilibrium with all other sulphur species in aqueous solution at 25°C, 1 atm total pressure, and 0.1 M total sulphur. In environments which might be expected under earth surface conditions almost all sulphur occurs as HSO_4^- , SO_4^{2-} , S, H_2S , and HS^- .

R. C.

CULVER (R. V.), GRAY (N. B.), & SPOONER (E. C. R.). *Oxidation of galena to lead sulphate*. *Nature*, 1961, **190**, 78-79, 1 fig.

The reaction depends on the temperature and sulphur dioxide content of the atmosphere. M. J. LE B.

PAYNE (K. W.) & HALLAM (A.). *Germanium enrichment in lignites from the Lower Lias of Dorset*. *Nature*, 1958, **181**, 1008-1009.

Spectrographic analyses of two types of lignite gave 0.024 to 0.93% Ge, compared with 1.7 to 3.9 p.p.m. in the parent rocks. Ge was probably adsorbed from circulating solutions after burial of the coniferous driftwood.

C. H. K.

FYFE (W. S.). *The possibility of d-electron coupling in olivine at high pressures*. *Geochim. Cosmochim. Acta*, 1960, **19**, 141-143.

High pressures in the earth's mantle may induce d-electron coupling in the Fe^{2+} of fayalite thus causing volume reduction in the olivine of the mantle. R. C.

HERRMANN (A. G.) & HOFFMANN (R. O.). *Zur Genese einiger Borate in den Salzablagerungen der Stassfurtserie des Südharzbezirktes einschliesslich der Grube Königshall-Hindenburg*. *Neues Jahrb. Min., Monatshefte*, 1961, 52-60.

Oil brines in the southern Harz zone are unusually rich in Sr, B, P, and F, in addition to CaCl_2 . The migration of these oil brines in the evaporite series has given rise to the borates danburite, strontiohilgardite, p-veatchite, and strontioginorite, the phosphates lüneburgite, wagnerite, and isokite, and the magnesium fluoride sellaite.

R. A. H.

HERRMANN (A. G.). *Über die Einwirkung Cu-, Sn-, Pb- und Mn-haltiger Erdölwässer auf die Stassfurtserie des Südharzbezirktes*. *Neues Jahrb. Min., Monatshefte*, 1961, 60-67.

Oil brines in the main dolomite of the southern Harz zone are rich in CaCl_2 and have an average trace element content of Cu $1.7 \times 10^{-5}\%$, Sn $1.4 \times 10^{-5}\%$, Pb $3.9 \times 10^{-5}\%$, and Mn $1.2 \times 10^{-4}\%$. These brines formed kieserite-carnallite

alt in anhydrite-sylvine salt. The behaviour of the trace elements in the recrystallization processes has been particularly studied.

R. A. H.

YANAKA (SHINYA). *Distribution of heavy water in natural waters*. Journ. Earth Sci. Nagoya Univ., 1953, **1**, 42-61, 5 figs., 15 tables.

The concentration of heavy water was determined in natural sources of many types. The highest concentrations were found in the ocean, the lowest in snow.

A. P.

YANAKA (MOTOHERU). *Étude chimique sur le métabolisme minéral dans les lacs*. Journ. Earth Sci. Nagoya Univ., 1953, **1**, 119-134, 11 tables.

The waters of three lakes in Japan have been analyzed to determine the variation of the concentration of iron, manganese, phosphate, silica, aluminium, and nitrogen with depth and season.

A. P.

SUGAWARA (KEN), NAITÔ (HIDEO), & YAMADA (SETSUO). *Geochemistry of vanadium in natural waters*. Journ. Earth Sci. Nagoya Univ., 1956, **4**, 44-61, 3 figs., 12 tables.

The vanadium content was determined in numerous samples of meteoric, spring, river, lake, and sea waters, in the sediments of Tokyo Bay, and in plankton. Some aspects of the vanadium cycle in aqueous media are discussed.

A. P.

SUGAWARA (KEN) & TERADA (KIKUO). *Iodine distribution in the western Pacific Ocean*. Journ. Earth Sci. Nagoya Univ., 1957, **5**, 81-102, 1 fig., 5 tables.

The iodine content of sea water has been determined in 26 samples collected from different levels at 50 stations in the region between Japan, the Bering Sea, and Hawaii. In the surface waters total iodine tends to decrease towards the equator. No regular vertical variation can be observed. The supply and removal of oceanic iodine are discussed.

A. P.

Applied

UKLONSKIĬ (A. S.) [Уклонский (A. C.)]. О перемещенных минералах [*On displaced minerals*]. Изд. Акад. Наук УзССР [Bull. Acad. Sci. Uzbek S.S.R.], 1955, **8**, 37-41.

The term 'displaced' is applied to minerals formed in an ore deposit under the influence of percolating solutions. Criteria for such minerals are discussed, and a number are enumerated. Such, for example, are silicates and aluminosilicates containing heavy metals, aluminosilicates containing sulphur, chlorine, or carbonate, and so on.

S. I. T.

SAUKOV (A. A.). *Migration of chemical elements as a theoretical basis of geochemical search methods*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **2**, 28-37.

The migration of chemical elements during the formation or erosion of deposits gives rise to syngenetic and epigenetic dispersion aureoles. In these aureoles the associated elements may be more convenient indicators of deposits than the direct indicators. Geochemical exploration must take into account the geochemical features of the landscape and the thickness of superficial deposits. Some examples from the U.S.S.R. are quoted.

R. A. H.

NOSKE (G.) & SÄRCHINGER (H.). *Geophysikalische Untersuchungen zwischen den Mineralquellengebieten von Bad Elster und Bad Brambach*. Rept. 21st Intern. Geol. Congr., Norden, Part **2**, 137-147, 7 figs.

Investigation of the strata giving rise to mineral springs at Elster and Brambach in southwestern Saxony revealed a magnetic anomaly connected with magnetite and pyrrhotine in a feldspar-mica-schist.

R. A. H.

BERCE (BORIS). *Method and results of geochemical investigations of mercury*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **2**, 65-74, 7 figs.

In the area near Idrija, Yugoslavia, cinnabar mineralization occurs in Permian and Triassic dolomites. Since deposition, part of the cinnabar has been dissolved and re-deposited but the transportation does not appear to have exceeded 10 metres. The factors controlling the primary dispersion of Hg include the porosity of beds, the depth beneath the surface, and the composition of the solutions.

R. A. H.

POLLOCK (J. P.), SCHILLINGER (A. W.), & BUR (T.). *A geochemical anomaly associated with a glacially transported boulder train Mt. Bohemia, Keweenaw County, Michigan*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **2**, 20-27, 3 figs.

Near an intrusion of syenodiorite, andesite-basalt flows have been selectively mineralized in the top, amygdaloidal part of the flow with disseminated chalcocite and bornite. A geochemical study of the thin mantle of boulder clay covering the area traced the Cu to near the source, and self-potential studies pin-pointed the outcrop.

R. A. H.

HAWKES (H. E.) & SALMON (M. L.). *Trace elements in organic soil as a guide to copper ore*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **2**, 38-43, 3 figs.

A brief report on experimental geochemical prospecting work at Captain Mines, Bathurst District, New Brunswick. Well-defined dispersion patterns of Fe and Cu derived from a buried copper-bearing iron sulphide deposit were mapped by analysis of swamp material. Details are given for the colorimetric determination of total Cu, total Fe, and readily

extractable Fe, and for the X-ray fluorescence analysis of Cu and Fe. R. A. H.

GOVETT (G. J. S.). *Geochemical prospecting for copper in Northern Rhodesia*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 2, 44–56, 3 figs.

Analyses of 13,000 soil and stream samples from the Rhodesian Copperbelt have shown that the basic pattern of secondarily dispersed Cu in regions of mineralization is related to groundwater movement and to residual Cu in the soils. Variation in the amount of Cu in soils and stream sediments is primarily related to organic carbon content, cation-exchange capacity, and mechanical composition. [M.A. 14-494] R. A. H.

DREIMANIS (A.). *Geochemical prospecting for Cu, Pb and Zn in glaciated areas, eastern Canada*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 2, 7–19, 6 figs.

HISTORY AND BIOGRAPHY

[SHAKHOVSKAYA (A. D.)] Шаховская (А. Д.). Кабинет-музей В. И. Вернадского [*Study-museum of V. I. Vernadsky*]. Изд. Акад. Наук СССР [Publ. Acad. Sci. U.S.S.R.], 1959, 50 pp., 9 figs. Price 1r. 50k.

V. I. Vernadsky (1863–1945), a great mineralogist and geochemist, had also a great personality, and this small book written by his secretary brings out all the homely aspects of his life and work. His study, with its library, desks, and other furniture was reconstructed as a museum object in the Institute of Geochemistry and Analytical Chemistry in Moscow. Among other things, it is interesting to know that Vernadsky could follow the literature of science in fourteen languages, that his personal library contained 6800 books and journals, and that he had a particular interest in the history of science. S. I. T.

[UKLONSKIĬ (A. S.) & SHISHKIN (V. A.), editors] Уклонский (А. С.) и Шишкин (В. А.) редакторы. Русские ученые—исследователи Средней Азии. Том III. И. В. Мушкетов. Сборник документов [*Russian scientists—explorers of Central Asia. Vol. III. I. V. Mushketov. Collection of documents*]. Гос. Изд. Узб. ССР [State Publ. Uzbek S.S.R.], Tashkent, 1960, 334 pp., 10 figs. Price 14r. 25k.

Ivan Vasilievich Mushketov (1850–1902), professor of geology in the Mining Institute in St. Petersburg, was the pioneer of geological research in Central Asia. This collection of official documents compiled and well annotated and indexed by Z. I. Agafonov, provides a most important background to Mushketov's scientific work. The appended

In most indicator trains in eastern Canada detrital particles of ore minerals amount to less than 1% and geochemical anomalies are low (2–3 times the background values). Higher anomalies result from upward migration or groundwater transport of soluble weathering products of the ore minerals. The upwards migration appears to be restricted to the basal portion of the glacial deposits. R. A. H.

KENNEDY (VANCE C.). *Geochemical studies in the Coeur d'Alene district, Shoshone County, Idaho*. Bull. U.S. Geol. Survey, 1960, 1098-A, 1–55, 20 figs., 7 pls., 7 tables.

Analysis of soil for Pb and Zn is a feasible method of prospecting for new orebodies, but not for those of Cu. Plants growing in mineralized areas contain abnormal amounts of ore metals, but these anomalies are not so pronounced as those in the soil. K. S.

bibliography shows the wide range of subjects studied by Mushketov, besides his regular geological survey and mapping. Thus we see reports on gold, iron, copper, and lead-silver ores, graphite, sulphur, salt, and other deposits, as well as papers on jade, sodalite, syenite, volcanic rocks, glaciers, and earthquakes in Central Asia. S. I. T.

[TIKHOMIROV (V. V.)] Тихомиров (В. В.). Геология в России первой половины XIX века. Часть I [*Geology in Russia in the first half of the XIXth century. Part I*]. Изд. Акад. Наук СССР [Publ. Acad. Sci. U.S.S.R.], 1960, 228 pp., 24 figs., 2 maps. Price 11r. 70k.

This is a very important contribution to the history of geology. Half a century of progress in the development of geology is contained in 204 pages of text and 22 pages of bibliography, but unfortunately an index is lacking. This volume is marked as Part I as it contains only the introduction and a survey of regional geology, while as announced the second part will be concerned with the progress in various branches of geology. In the Introduction (pp. 7–78) we have first a survey of literature dealing with the history of geology in Russia. It is interesting to note that a book entitled 'Istoriya Mineralogii' (History of Mineralogy) written by A. M. Teryaev, was published in St. Petersburg in 1819. The first chapter of Tikhomirov's book deals with the development of geology in Russia prior to the XIXth century, in which the works of M. V. Lomonosov (1711–1765), P. S. Pallas (1741–1811) and J. G. Lehmann (1719–1767) are especially noted, as well as the early manuscript geological (petrographical) maps of regions situated in the Eastern Transbaikalia of Siberia, which were drawn in

1789–1794. The next chapter deals with the geological and mining surveys in Russia and the social-economic background during the first half of the nineteenth century. The 'Regional Studies' which follow, comprise seven chapters, the first five dealing with the progress of geological study of different regions of European and Asiatic Russia, chapter six dealing with geological mapping and collected works, and chapter seven with the work of Russian geologists outside Russia. A British reader may be interested in the reference

to the work of W. T. Strangways on the geology of Russia, published in the Transactions of the Geological Society of London in 1821 and 1824, and also in the account of the famous geological expedition to Russia by R. I. Murchison in 1841. The two appended copies of maps are: 'Petrographical Map of the Donetz Mountain Ridge' by E. P. Kovalevsky (1829) and the 'Geological Map of European Russia' (coloured) compiled by A. K. Meyendorf (1841).

S. I. T.

METEORITES AND TEKTITES

VÄNKE (H.). *Exposure ages for iron meteorites*. Nature, 1960, **188**, 1101–1102.

Criticizes the interpretation of results given in a paper by Schaeffer and Fisher [Nature, **186**, 1040]. M. J. LE B.

SCHAEFFER (O. A.). Nature, 1960, **188**, 1102.

Reply to criticism abstracted above. M. J. LE B.

BERNAL (J. D.). *Significance of carbonaceous meteorites in theories on the origin of life*. Nature, 1961, **190**, 129–131.

M. J. LE B.

FISHER (D. E.). *Origin of stone and iron meteorites*. Nature, 1961, **190**, 244–245, 2 figs.

One is not justified in postulating separate origins for stone and iron meteorites on the basis of their cosmic-ray exposure ages, because of space erosion. [M.A. **15**–38]

M. J. LE B.

TAYLOR (S. R.). *Distillation of alkali elements during formation of australite flanges*. Nature, 1961, **189**, 630–633, 2 figs.

The flange contains less Na, K, Li, Rb, and Cs than the core, and indicates a second period of melting. Urey's comet theory [M.A. **13**–363] is favoured. M. J. LE B.

FIREMAN (E. L.). *Argon-39 in the Sikhote-Alin meteorite fall*. Nature, 1958, **181**, 1613–1614.

The number of ^{39}Ar decays/g/day was found to be 0.0 ± 0.2 . Assuming that cosmic rays produce ^{39}Ar and ^{38}Ar at the relative rates of 1.5 : 1, and that the ^{38}Ar content is about 5% of the ^3He content, it is estimated that the meteorite was exposed to cosmic rays for 5×10^8 years. The Carbo meteorite has less than 0.4^{39}Ar decays/g/day and must therefore have fallen more than 1500 years ago.

C. H. K.

FIREMAN (E. L.). *Distribution of helium-3 in the Carbo meteorite*. Nature, 1958, **181**, 1725, 1 fig.

Measurements of ^3He by the method of neutron activation show that the meteorite was a non-spherical object in space. Comparison with experimentally produced variations in depth of tritium indicate that the average energy of the bombarding cosmic rays in space was greater than 5 B eV.

C. H. K.

VINOGRADOV (A. P.). *The isotopic composition of rocks of the earth and of meteorites*. Geochim. Cosmochim. Acta, 1959, **15**, 80–90, 4 figs.

A comparative study of the isotopic composition of igneous rocks and meteorites. Variations in the isotopic relations of rocks and meteorites are prime indicators of fundamental petrogenic and cosmogenic processes. Igneous rocks and meteorites have differing geneses. [M.A. **14**–410]

R. C.

SCHAEFFER (O. A.) & ZÄHRINGER (J.). *Helium, neon and argon isotopes in some iron meteorites*. Geochim. Cosmochim. Acta, 1960, **19**, 94–99, 1 fig.

He, Ne, and Ar isotopes have been quantitatively determined, using a mass spectrometer, in 7 octahedrites of widely varying He content. Assuming regular shape of meteoroids and equal exposure in space to cosmic radiation the $^3\text{He}/^4\text{He}$, $^3\text{He}/^{21}\text{Ne}$, and $^3\text{He}/^{38}\text{Ar}$ ratios, rather than the absolute amount of the isotopes, may represent a scale for the depth of a sample below the surface of the original meteoroid. [M.A. **14**–49, 127, 128]

R. C.

HONDA (M.), SHEDLOVSKY (J. P.), & ARNOLD (J. R.). *Radioactive species produced by cosmic rays in iron meteorites*. Geochim. Cosmochim. Acta, 1961, **22**, 133–154.

Details are given of the methods used in the determination of the radioactive isotopes ^{10}Be , ^{26}Al , ^{36}Cl , ^{40}K , and ^{53}Mn in meteorites. Results are tabulated for 4 octahedrites from Odessa, Texas; Grant, New Mexico; Williams-town, Kentucky; and Cañon Diablo, Arizona. The isotope ratios are approximately constant for each meteorite,

except for ^{53}Mn where a depth effect is visible. The cosmic ray ages of the Williamstown and Grant meteorites are considered to be similar. R. A. H.

HONDA (M.) & ARNOLD (J. R.). *Radioactive species produced by cosmic rays in the Aroos iron meteorite*. Geochim. Cosmochim. Acta, 1961, **23**, 219-232.

The content of 18 cosmic-ray produced radioactive nuclides has been determined for the iron meteorite Aroos which fell in Azerbaijan in 1959. The activities of the long-lived species ^{10}Be , ^{26}Al , and ^{53}Mn were similar to previous results for Williamstown and Grant meteorites [preceding abstract]: much less ^{40}K was found, however, indicating a shorter cosmic-ray age for the Aroos meteorite. Comparison of activities in certain groups indicates constancy of the cosmic-ray flux for millions of years. R. A. H.

SZTRÓKAY (K. I.). *Über einige Meteoritenminerale des kohlenwasserstoffhaltigen Chondrites von Kaba, Ungarn*. Neues Jahrb. Min., Abhandl., 1960, **94**, 1284-1294, 4 figs.

Investigation of the carbonaceous stone meteorite which fell in 1857 near Kaba, Hungary, showed in addition to magnetite also nickeliferous magnetite, pentlandite, and spinel (a 8.1003Å) not hitherto recorded in a meteorite. Metallic iron occurs partly intergrown with magnetite. The opaque constituents indicate peculiar conditions of formation. R. A. H.

KRINOV (E. L.). *The Kaaliyarv meteorite craters on Saaremaa Island, Estonian SSR*. Amer. Journ. Sci., 1961, **259**, 430-440.

A group of craters comprises a large one due to explosion, and six smaller ones due to impact of meteorites. The large one was blasted by a larger meteorite striking at cosmic velocity; the smaller ones are due to smaller fragments belonging to the same shower, but slowed by air friction. The largest is round, 110 metres diam., 17 metres deep below the highest part of the rim and 9 to 10 metres below the general land surface. No meteorite fragments remain in it. The smaller ones are 12 to 50 metres across, and less than 4 metres deep. They contain meteorite fragments. The general mechanics of formation are reviewed, and these craters are compared with Tunguska and Sikhote-Alin in the U.S.S.R., and with Brenham, Kansas, and others. One large, explosion crater is fairly commonly associated with several subsidiary impact craters. H. W.

KRINOV (E. L.). *The nature of micrometeorites*. Amer. Journ. Sci., 1961, **259**, 391-395, 6 figs.

Previously reported studies have indicated that meteorite showers are caused by the fragmentation of one large meteorite in the atmosphere rather than by the invasion

of a swarm of initially discrete particles. In the process many small particles, including microscopic dust particles, become separated from the main mass and develop the fusion crust and morphological properties of meteorites in general. They differ from cosmic dust which enters the atmosphere directly from interplanetary space in that cosmic dust particles are practically unaltered by impact with the atmosphere. Therefore, the use of term micrometeorites for cosmic dust particles is unfortunate. R. M. B.

[VOROB'EV (G. G.)] Воробьев (Г. Г.). Новые данные о тектитах [New data on tektites]. Доклады Акад. Наук СССР [C.R. Acad. Sci. U.S.S.R.], 1959, **128**, 61-62, 3 figs.

Risalites from the Philippines are made of black glass, with numerous spherical cavities 1-2 mm diam. They also contain magnetite spheres, 0.2-2 mm diam., covered with a limonite crust. Magnetite spheres are also found in indochinites. It is assumed that the magnetite spheres are of cosmic origin. S. I. T.

BARNES (VIRGIL E.). *Origin of tektites*. Nature, 1958, **181**, 1457.

The non-uniform distribution of tektites on the earth's surface and the distinctive characteristics of a few of the tektite groups discredit the theories that the moon is a source of tektites. [M.A. 14-133] C. H. K.

KOPAL (Z.). *Origin of tektites*. Nature, 1958, **181**, 1457-1458.

If tektites are ejected from the moon by an impact of a meteorite, they would occur over a larger area of the earth's surface. If they are of the same material as that constituting lunar rays round certain craters then they should exhibit luminescence in the region of 4000Å. [M.A. 14-133] C. H. K.

UREY (H. C.). *Origin of tektites*. Nature, 1958, **181**, 1458.

Tektites have high percentages of silica and alumina and it seems unlikely that they could originate from the moon. If they do, then its igneous rocks must be markedly different from those of the earth. Ejection from the moon would imply a general distribution of tektites. [M.A. 14-133] C. H. K.

KAYE (C. A.), SCHNETZLER (C. C.), & CHASE (J. N.). *Tektite from Martha's Vineyard, Massachusetts*. Bull. Geol. Soc. America, 1961, **72**, 339-340, 2 pls.

A chemical analysis and description are given of a possible tektite fragment found on the cliff of Gay Head, on Martha's Vineyard, Massachusetts. If genuine, this becomes the third tektite locality in the Western Hemisphere. A. L. A.

MINERAL DATA

СРЕБРОДОЛЬСКИЙ (B. I.), АРХИПОВА (L. D.), & КУЗНЕЦОВ (G. V.) [Сребродольский (Б. И.), Архипова (Л. Д.), и Кузнецов (Г. В.). О находке гауэрита в Роздольском месторождении самородной серы [*Finding of hauerite in the Rozdol native sulphur deposit*]. Проблемы геохимии. I. Изд. Львов Унив. [Problems of geochemistry. I. Publ. Lvov Univ.], 1959, pp. 296–300, 5 figs., (English summary, p. 314).

Hauerite crystals have been found in calcareous clays of Rozdol sulphur deposit in the Ukraine. Chemical analysis and X-ray and other data are given. S. I. T.

CHRIST (C. L.) & CLARK (JOAN R.). *Crystal chemical studies of some uranyl oxide hydrates*. Amer. Min., 1960, **45**, 1026–1061, 3 figs.

Mineralogical and crystal-chemical studies have been made of the closely related uranyl oxide hydrates becquerelite $\text{CaO} \cdot 6\text{UO}_3 \cdot 11\text{H}_2\text{O}$, billietite $\text{BaO} \cdot 6\text{UO}_3 \cdot 11\text{H}_2\text{O}$, fourmarierite $\text{PbO} \cdot 4\text{UO}_3 \cdot 4\text{H}_2\text{O}$, masuyite, schoepite, and vandendriesscheite. Indices of refraction and optical orientation were determined on crystals both identified and oriented by the X-ray precession method. Similarly identified crystals were used to obtain indexed powder patterns for each of the minerals. The results obtained on optical and other physical properties, X-ray crystallography, and powder patterns are set forth and compared with the results of other investigators in 23 tables. Crystals of schoepite and of vandendriesscheite that are apparently single, consist of several distinct phases in parallel intergrowth. The spontaneous alteration from one phase to another that occurs in these crystals results from loss of water of hydration. All six minerals are orthorhombic, have perfect {001} cleavage and yield strikingly similar pseudo-hexagonal diffraction patterns. A reasonable crystal structure based on these patterns consists of $\text{UO}_2(\text{OH})_2$ layers parallel to the cleavage with water of hydration and any cations in interlayer positions. A. P.

NEUMANN (H.) & SVERDRUP (T. L.). *Contributions to the mineralogy of Norway*. No. 8. *Davidite from Tuftan, Iveland*. Norsk Geol. Tidsskr., 1960, **40**, 277–288, 4 figs.

In all about 200 kilograms of davidite have been found in the Tuftan dyke, one of the few in Norway worked for rare minerals, thortveitite, gadolinite, and euxenite, and yielding some feldspar and quartz as by-products. Minerals identified are: microcline, plagioclase, quartz, biotite, muscovite, garnet, allanite, zircon, beryl, gadolinite, thortveitite, euxenite, blomstrandine, davidite, magnetite, monite, rutile, xenotime, pyrite, and molybdenite.

Chemical analysis of the davidite shows 0.34 SiO_2 , 52.1 TiO_2 , 17.3 RE_2O_3 , 1.1 U_3O_8 , 9.5 Fe_2O_3 , 17.1 FeO , 1.0 MnO , 1.63 H_2O , [= 100.07]. The ignited precipitate of the rare earths was determined by optical spectrography (O. Joensuu) and X-ray spectrography (A. Kvalheim) respectively as: Y_2O_3 23, 20.6; La_2O_3 22, 17.3; CeO_2 32, 39.2; Pr_6O_{11} 2.4, Pr_2O_3 1.8; Nd_2O_3 2.8, 3.8; Sm_2O_3 <0.2, 0.2; Eu_2O_3 0.4, nil; Gd_2O_3 <0.1, tr.; Tb_4O_7 <0.2, Tb_2O_3 tr.; Dy_2O_3 1.6, 1.5; Ho_2O_3 0.55, 0.7; Er_2O_3 2.5, 2.3; Tm_2O_3 1.2, 1.0; Yb_2O_3 9.5, 9.9; Lu_2O_3 1.7, 1.7; ThO_2 1.5, 1.4%. The pure rare earth end-member approaches the composition $\text{Y}_2\text{Fe}_6\text{Ti}_{12}\text{O}_{33}$ (where Y is yttrium + lanthanides). The pure U end-member may be $\text{U}_2\text{Fe}_6\text{Ti}_{10}\text{Fe}_2\text{O}_{33}$ or $\text{U}_{3/2}\text{Fe}_6\text{Ti}_{12}\text{O}_{33}$. The composition of the rare earths is unusual as there is pronounced enrichment of large and small ions while the content of middle-sized ions is exceptionally low, but the authors cannot unconditionally accept the view of Dixon and Wylie [M.A. 11–541] that davidite is a mixture of more than one mineral species. X-ray powder data for a heated sample of the Tuftan davidite are given. Davidite occurs in Norway at Åmot, Modum parish, and N. of Bringebaerkastet, Langøy Island. K. S. H.

STRUNZ (H.). *Über den Andradit von Wurlitz im Fichtelgebirge*. Der Aufschluss, 1960, 173–174, 1 fig.

Andradite, associated with calcite, talc, and diopside in joints in serpentinite at Wurlitz, has n 1.862, α 12.053 Å, sp. gr. 3.78. Analysis gave SiO_2 35.19, Fe_2O_3 30.38, CaO 34.87, = 100.44, indicating it to be very close to the end-member composition. It is light green in colour; in addition to the forms {110} and {211} it shows the hexakisoctahedron {32.31.1}. R. A. H.

SHIBATA (HIDEKATA). *Spodumene and amblygonite from the Bunsen mine, and other localities in Korea*. Sci. Rept., Tokyo Univ. of Education, sect. C, 1952, **2**, 145–153, 4 figs., 6 tables.

Zinnwaldite, lepidolite, lithium-tourmaline, amblygonite, and spodumene are found towards the central portion of altered parts of a microcline pegmatite. The spodumene from the Bunsen mine gave on analysis by the author SiO_2 64.16, Al_2O_3 26.42, Fe_2O_3 0.22, FeO 0.12, MnO nil, MgO 0.09, CaO 0.80, Na_2O 0.52, K_2O 0.13, Li_2O 7.48, ign. loss 0.76, = 100.70; α 1.648, β 1.654, γ 1.662, all ± 0.001 , extinction 15° on (010) parting. The mineral forms white crystals tabular on (100) up to 20 cm long parallel to the c -axis; it weathers to a talcy aggregate of sericite (analysis given). Amblygonite from the Bunsen mine gave on analysis by the author SiO_2 1.14, P_2O_5 46.77, Al_2O_3 32.13, FeO 0.21, MnO nil, MgO 0.18, CaO 0.18, Na_2O 1.15, K_2O

1.33, Li_2O 9.64, $\text{H}_2\text{O} +$ 5.38, $\text{H}_2\text{O} -$ 0.20, F 3.13, =101.44 -1.32 O for F, =100.12; α 1.585, β 1.598, γ 1.606, all ± 0.001 , $2V$ (calc.) 77.5° ; the mineral shows lamellar polysynthetic twinning and is turbid with fluid inclusions. Amblygonite from the Uruchin mine gave SiO_2 1.89, P_2O_5 46.80, Al_2O_3 32.31, FeO 0.13, MnO nil, MgO 0.48, CaO 2.54, Na_2O 0.51, K_2O 0.41, Li_2O 7.21, $\text{H}_2\text{O} +$ 5.32, $\text{H}_2\text{O} -$ 0.50, F 3.20, =101.20, -1.34 O for F, =99.86; no optical data given. Analyses of muscovite, phengite, Li-phengite, and lepidolites (two) are also given. The distribution of the minerals in the pegmatite at the Bunsen mine is shown in 4 large-scale diagrams. A. P.

SHIBATA (HIDEKATA). *Mineralizations in granite-pegmatites in Japan and Korea*. Parts I, II, & III. Sci. Rept., Tokyo Univ. of Education, sect. C, 1952, **2**, 63-90(?), 107-144, 155-206, 55 figs., 18 tables.

Parts I and II include a summary of the common features of granite pegmatites, especially Li-pegmatites, as seen in occurrences in Japan and Korea. The development of the several stages of pegmatites is shown in paragenesis diagrams for the pegmatites of the Naegi district, the Ginkoku, Tanryoku, and Bunsen mines [see preceding abstract], and the pegmatites of Nagatare, of the Ishikawayama region, and of part of the Abukuma plateau. An analysis of petalite from Nagatare is SiO_2 77.62, Al_2O_3 16.39, Fe_2O_3 0.19, FeO 0.15, MgO 0.16, CaO 0.52, Na_2O 0.52, K_2O 0.12, Li_2O 4.49, ign. loss 0.66, = '100.63'. Analyses of twelve micas from various pegmatites are reported. Part III is devoted largely to a summary of the evolution of pegmatitic micas. Analyses and atomic ratios are tabulated for 80 micas, including 28 analysed by the author. The composition of each is expressed in terms of the end-members polyolithionite, lepidomelane, and muscovite. The data are treated graphically in various ways leading to a 'supposed diagram of temperature-phase relation of pegmatitic micas'. Finally there is a discussion of contamination of pegmatites.

A. P.

KUZEL (H.-J.). *Über Formel und Elementarzelle des Sapphirin*. Neues Jahrb. Min., Monatshefte, 1961, 68-71, 1 fig.

X-ray investigations of single crystals of natural sapphirines, from Fiskernäs, Greenland [M.A. 4-109], and Blinkwater, Transvaal, indicate a monoclinic cell with a 11.26, b 14.46, c 9.95 Å, β $125^\circ 20'$, space group $C_{2h}^5-P2_1/c$; sp. gr. 3.49, $Z=8$, assuming a formula $2\text{MgO} \cdot 2\text{Al}_2\text{O}_3 \cdot \text{SiO}_2$. Synthetic sapphirine has α 1.701, γ 1.705, $2V_\alpha$ 64° , γ : c 13° , O.A.P. (010); a 11.26, b 14.42, c 9.93 Å. For Al_2O_3 -rich sapphirines crystallized from a melt the formula $\text{Mg}_7\text{Al}_{18}\text{Si}_3\text{O}_{40}$ is suggested. [M.A. 11-197, 12-82]

R. A. H.

JUNG (D.). *Untersuchungen an Granat in einem Felsitporphyr: Beitrag zur Frage der Herkunft rhyolithischer Schmelzen*. Neues Jahrb. Min., Monatshefte, 1961, 1-11, 9 figs.

Red garnet, biotite, and feldspar occur as phenocrysts in a Permian rhyolite of the Saar-Nahe-Pfalz region. Analysis of the garnet, by E. Chytreck, gave SiO_2 37.62, TiO_2 0.58, Al_2O_3 21.36, Fe_2O_3 1.82, FeO 27.25, MnO 1.13, MgO 4.35, CaO 6.04, P_2O_5 0.08, = '100.24', giving approximately $\text{Alm}_{62}\text{Py}_{18}\text{Gro}_{17.5}\text{Sp}_{2.5}$; n 1.799, a 11.588 Å, sp. gr. 4.01; the indexed X-ray powder reflections are tabulated. From comparison with other garnets it is considered that this almandine is not a true magmatic product but represents a relict of the original rock which by anatexis mobilization formed the rhyolitic melt. An analysis of the rhyolite is also given. [M.A. 7-133, 14-208] R. A. H.

[BOBRIEVICH (A. P.), SMIRNOV (G. I.), & SOBOLEV (V. S.)] Бобриевич (А. П.), Смирнов (Г. И.) и Соболев (В. С.). Ксенолит эклогита с алмазами [*An eclogite xenolith with diamonds*]. Доклады Акад. Наук СССР [C.R. Acad. Sci. U.S.S.R.], 1959, **126**, 637-640.

An eclogite xenolith in the 'Mir' kimberlite pipe [Central Siberian Plateau] consists of a coarse-grained aggregate of >50% red-orange garnet (n 1.767, a 11.542 kX) and dark-green clinopyroxene (α' 1.682, γ' 1.705, γ : c $36-38^\circ$, $2V$ 65°), the latter containing plane-faced octahedra of diamond, sometimes >2 mm in size, and platelets of graphite; the relationship between the last two minerals is not clear. The origin of the xenolith is discussed. Analysis of the garnet by E. A. Kolesnikova gave SiO_2 41.82, TiO_2 0.04, Al_2O_3 21.60, Fe_2O_3 2.05, Cr_2O_3 0.04, FeO 18.99, MnO 0.39, MgO 9.36, CaO 5.86, H_2O n.d., =100.15. Three analyses (with n and a values) of garnets from inclusions in other pipes are given. [M.A. 13-398 and 649] G. R.

SAMBONSUGI (MIYOJI). *Iron-rich cordierite structurally close to indialite*. Proc. Japan Acad., 1957, **33**, 190-195, 5 figs., 3 tables.

The chemical analysis of an iron-rich cordierite occurring in a pegmatite of the Abukuma plateau, northeast Japan, is SiO_2 44.64, Al_2O_3 29.96, Fe_2O_3 2.72, FeO 11.02, MnO 1.86, CaO 0.02, MgO 3.08, P_2O_5 n.d., Na_2O 2.05, K_2O 0.75, $\text{H}_2\text{O} +$ 3.85, $\text{H}_2\text{O} -$ —, =99.95. Its properties are: α 1.560, β 1.574, γ 1.578, $2V_\alpha$ 55° , sp. gr. 2.659. The structural relation to indialite is shown only by comparison of a small segment (ca. 1°) of the diffractometer patterns, no other X-ray or structural data being given. The chemical analysis of an associated pyralispite is reported. A. P.

FAUQUIER (DANIEL). *Sur la 'wiikite' et la 'loranskite'*. C.R. Acad. Sci., Paris, 1960, **250**, 3032-3034.

These minerals belong to the group of metamict niobantalates; they are distinctive of the pegmatites of Karelia M.A. 14-254] and some varieties have been found in Lapland [M.A. 11-226, 227]. Wiikite and loranskite occur massive mixed with feldspar, which is milky from trains of wine-lees' inclusions, and enclosed in black mica. Three varieties are distinguished by colour; yellow-ochre, black, and brown-red. The first is related to betafite—by the presence of rutile after calcination which shows a deficit of CaO—and also to pyrochlore—by the presence of CaCO₃ and conditions of deposit. The other two varieties are related to allanite and gadolinite.

E. J. & A. S.

VAN WAMBEKE (L.). *Étude comparative de l'ampangabéite et de la samarskite*. Bull. Soc. franç. Min. Crist., 1960, **83**, 295-309, 5 figs.

D.t.a., X-ray diffraction, and X-ray fluorescence techniques have been used to study 7 samarskites and 6 ampingabéites from Madagascar, Brazil, Norway, and Colorado. Allowing for possible ionic replacement, the inner zones of these two minerals were found to have identical chemical compositions: the outer weathered zones showed a leaching of Y, U, and Ca and often an enrichment in Pb. After heat treatment the X-ray diffraction patterns of both the inner and the weathered zones of samarskites and ampingabéites are identical. The d.t.a. curves show for the inner zones of both minerals an exothermic peak at 710°-715°C and for the weathered zones an exothermic peak at about 670°-685°C. The identity of ampingabéite with samarskite is thus established: for their weathered zones the formula proposed is $AB_{2+x}[O,(OH)_2]_{6+2.5x}.nH_2O$, where $A=Y, Ce, U, Ca, Fe, Th, Pb$, and $B=Nb, Ta, Ti, Sn$. R. A. H.

TRUNZ (H.). *Karyinit, ein Arsenat vom Strukturtypus der Phosphate Hagendorfit und Alluaudit*. Neues Jahrb. Min., Monatshefte, 1960, 7-15, 4 figs.

Karyinite, an arsenate mineral [M.A. 14-498] from Ångbän, Sweden, hitherto classed with graftonite-magniophillite or with berzeliite, is shown to be isotypic with the phosphate minerals hagendorfit-arulite-hühnerkobelite-alluaudit. Karyinite has a 2.42, b 13.17, c 6.87Å, β 114°20'; space group C_{2h}^6-C2/c ; formula $(Na,Ca)_2(Mn,Mg,Ca,Pb)_3[AsO_4]_3$, with $Z=4$. New data for hagendorfit from Hagendorf, Bavaria, include (yellowish brown) 1.735, β (green) 1.742, γ (blue-green) 1.745; $\beta:c$ 22°, $\gamma||b$, $2V_r \approx 70^\circ$, $r > v$, O.A.P. \perp (010) [M.A. 12-462]. R. A. H.

TRUNZ (H.). *Isotypie Palermoit-Carminit $SrAl_2[OH|PO_4]_2-PbFe_2[OH|AsO_4]_2$* . Neues Jahrb. Min., Monatshefte, 1960, 49-52, 1 fig.

Palermoite and carminite, hitherto classed with lazulite and brazilianite respectively, are shown to be isotypic, with similar formulae and analogous cell parameters [M.A. 7-260, 12-131]. There is also some relation between these minerals and the members of the descloizite series such as conichalcite and duftite [M.A. 7-494, 8-11]. R. A. H.

OMORI (KEIICHI) & HASEGAWA (SHUZO). *Titanite from a pegmatite at Ishikawa Town, Fukushima Prefecture*. Sci. Rept. Tohoku Univ., 3rd ser., 1956, **5**, 139-142, 2 figs., 3 tables.

The titanite is embedded in microcline perthite at the margin of the pegmatite as crystal aggregates up to 3 cm. Analysis gives SiO₂ 30.65, TiO₂ 37.64, Al₂O₃ 2.95, Fe₂O₃ 0.71, Y₂O₃ nil, FeO nil, MnO 0.10, CaO 27.05, MgO nil, ign. loss 0.45, = 99.55, sp. gr. 3.510. A. P.

FLOOR (P.). *Astrofilita un mineral nuevo en España*. Notas y comunicaciones Inst. Geol. Min. España, 1961, no. 62, 59-72, 5 figs., 3 tables, (English summary).

An occurrence of astrophyllite, in aegirine-riebeckite gneisses and associated pegmatites, in the Spanish province of Pontevedra is described. Optical and X-ray diffraction data are given. The indices of refraction β and γ are considerably higher than most of those listed in the literature: 1.722 and 1.757 in gneiss; 1.726 and 1.758 in pegmatite, all values ± 0.002 . Measurement of β and γ in astrophyllite from Brevik (Norway) and from St. Peter's Dome (Colorado, U.S.A.) led to very similar results. Strong dispersion of the optic axes is observed: $+2V_{red}$ approx. 88°, $+2V_{green}$ 82° in gneiss; but $+2V_{red}$ approx. 79° and $+2V_{green}$ 67° in pegmatite. Strongest lines of the X-ray powder patterns are: 10.2Å (ss), 3.47Å (ss), and 2.75Å (s). Astrophyllite has not previously been reported from Spain. [M.A. 13-384, 14-500] P. C. Z.

[FIRSOV (L. V.)] Фирсов (Л. В.). О находке сейригита на северо-востоке СССР [On the discovery of seyrigite in north-eastern U.S.S.R.]. Доклады Акад. Наук СССР [C.R. Acad. Sci. U.S.S.R.], 1959, **126**, 155-156.

Pale-green or brownish grains of seyrigite, sometimes showing {011} faces, accompany scheelite in the molybdenite ores at Usinsk, 18 km NW of Magadan, Siberia. Seyrigite has sp. gr. 5.494 ± 0.006 ; refr. ind. 1.940-1.990; $\epsilon-\omega$ 0.016-0.020; and fluoresces yellowish-green. Anal. by M. V. Kaniukova gave CaO 21.25, WO₃ 63.00, MoO₃ 13.48, FeO tr., H₂O 0.24, = 97.97, corresponding to $Ca_{1.027}(W_{0.736}Mo_{0.254})O_4$; Fe and Bi (<0.01%) were detected spectroscopically. Seyrigite is later than quartz, microcline, and biotite but earlier than molybdenite, chalcopyrite, pyrrhotine, etc. Age determinations [details?]

for the Magadan granodiorite batholith, the granite bosses and the pegmatites, respectively, gave 115, 90–100 and 75–80 m.y.

G. R.

STRUNZ (H.). *Tsumeb, seine Erze und Sekundärminerale, insbesondere der neu aufgeschlossenen zweiten Oxydationszone*. Fortschr. Min., 1959, **37**, 87–90, 5 figs., 2 pls.

Brief details are given of minerals of the second oxidation zone (820 to 1000 metres depth) at the Tsumeb Cu–Pb–Zn deposit, South-West Africa. These include gallite [M.A. **14**–279]; reniérite [M.A. **10**–454]; stottite [M.A. **14**–281]; reinerite [M.A. **14**–282]; cuproadamite with a 8.42, b 8.40, c 5.99 Å, $\alpha \approx 1.654$, β 1.755, $r > v$; conichalcite with a 5.84, b 9.22, c 7.41 Å; zinclavendulan with a 9.87, b 38.7, c 9.99 Å; claudeite with a 5.3, b 13.0, c 4.56, $\beta \approx 94^\circ$; zincrosasite; mineral R [chudobaite, M.A. **14**–500]; and mineral S, tetragonal, a 6.70, c 9.53 Å, strongest reflections 1.54 (10), 2.87 (8), and 2.96 (7) Å, H $3\frac{1}{2}$ –4, high reflectivity; probable formula $(\text{Ni,Cu})_2\text{GeS}_4$.

R. A. H.

[SERDYUCHENKO (D. P.) & BELOV (N. V.)] Сердюченко (Д. П.) и Белов (Н. В.). О так называемом «сулуните» [On so-called 'sulunite']. Зап. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1960, **89**, 367–368.

The green mineral encrusting Middle Carboniferous plant fragments from the Donets basin [M.A. **14**–501] is not a new mineral related to the hydromica gumbelie. Not all chlorites have a small optic axial angle and low birefringence, nor do they all have a low alkali content. A recalculated formula gives: $(\text{K}_{0.48}\text{Na}_{0.58})\text{Mg}_{0.07}\text{Fe}_{0.89}\text{Al}_{3.07}[\text{Al}_{0.15}\text{Si}_{3.85}\text{O}_{10}]\text{O}_{1.5}(\text{OH})_{5.0}$. X-ray, thermal, and optical data, chemical analysis, and structural formula all show it to be a chlorite, presumably of the alkali (K–Na) group. [M.A. **12**–405; A.M. **45**–478]

O. B.

[BONSHTEDT-KUPLETSKAYA (E. M.) Бонштедт-Куплетская (Э. М.). Новые минералы IX. [New minerals. IX] Зап. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1960, **89**, 63–81.

This article also [see p. xxx] includes the following additional data on new and other minerals:

ZEMANN (J.). *Der Strukturtyp von Stottit*. Neues Jahrb. Min., Monatshefte, 1959, 67–69, 1 fig.

Stottite, first described as a germanate, is a hydroxide with composition near $\text{Fe}^{\text{II}}\text{Ge}(\text{OH})_6$. Infrared spectra show absence of H_2O . The structure is probably analogous to that of $\text{NaSb}(\text{OH})_6$ in which Na and Sb are surrounded octahedrally by six OH. [M.A. **14**–281; A.M. **43**–1006]

STRUNZ (H.). *Bellit, ein Chromat-Apatit*. Naturwiss., 1958, **45**, 127–128.

Bellite, described previously as an As-bearing lead chromate (Petterd, 1904), belongs to the apatite structural group: a 10.135, c 7.39 Å; $a : c = 0.729$; ω 2.22, ϵ 2.10. Proposed formula: $(\text{Pb,Ag})_5(\text{C}_2\text{O}_4)_4\text{AsO}_4(\text{SiO}_4)_3\text{Cl}$. [A.M. **43**–798; M.M. **14**–395]

STANGACILOVIC (D.). *Sur la présence d'illite chromifère dans le gisement d'Avala, près de Belgrade*. C.R. Acad. Sci. Paris, 1956, **242**, 145–147.

Avalite described as a variety of fuchsite (Losanitskiy, 1884) is a Cr-bearing illite. [A.M. **42**–122]

STRUNZ (H.) & MICHEELSEN (H.). *Calcium-Phyllosilikat*. Naturwiss., 1958, **45**, 515.

Radiophyllite described by A. & P. Brauns (1924) as a member of the gyrolite group is identical with zeophyllite 'truscottite' = reyerite. [A.M. **44**–470]

O. B.

NEW MINERALS

STUMPFEL (E. F.). *Some new platinoid-rich minerals, identified with the electron microanalyser*. Min. Mag., 1961, **32**, 833–847, 7 figs., 1 pl.

The ore from the pipe-like body of dunite cutting the norites of the critical zone of the Bushveld complex at Dreikop, eastern Transvaal, contains chalcopyrite and pyrrhotine and small quantities of pentlandite, valleriite, covelline, braggite, cooperite, laurite, osmiridium, iridosmine, native platinum, sperrylite, native copper, and native gold [M.A. **4**–145]. Using the X-ray microanalyser ten new minerals were recognised, occurring as fine intergrowths in the platinum concentrates, with formulae approximating to PtSb_2 , PtSb , $\text{Pt}(\text{Sb,Bi})$, $(\text{Pt,Ir})\text{As}_2$, $\text{Pt}(\text{Ir,Os})_2\text{As}_4$, Pd_2CuSb , $\text{Pd}(\text{Sb,Bi})$, Pd_8CuSb_3 , $\text{Pt}_4\text{Sn}_3\text{Cu}_4$, and $(\text{Fe,Ni})_2\text{S}$. Details

given include the analytical results, hardness, reflectivity, and other properties observable in reflected light. The name *geversite* is proposed for the PtSb_2 phase which occurs both as widespread small isolated grains and intergrowths with other ore minerals. Analysis gave Pt 45.0, Sb 51.5%, H. $4\frac{1}{2}$ –5; grey and isotropic in polished section: the name is in honour of Prof. T. W. Gevers.

R. A. H.

[KON'KOVA (E. A.) & SAVEL'EV (V. F.)] Конькова (Е. А.) Савельев (В. Ф.). О новом таллиевом минерале — авиценните [A new thallium mineral — avicennite]. Зап. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1960, **89**, pp. 316–320, 2 figs.

Avicennite from the Zirbulak Mts., Uzbek S.S.R., occurs

s minute black cubes in limonite-quartz veins. Metallic lustre, cleavage indistinct, fracture uneven, H. 3-5, streak cinnamon-black. Sp. gr. was not determined because of the variable composition. The first account [M.A. 14-278] proposed the formula $7\text{Ti}_2\text{O}_3 \cdot \text{Fe}_2\text{O}_3$. X-ray data now shows vicennite to be related to the cubic modification of thallium sesquioxide, with space group $T_h^7\text{-Ia}3$, a 10.52 Å, $Z=16$. Formula $\text{Ti}_{32}\text{O}_{48}$, with 79.52% Ti. Iron (4.6%) is a mechanical admixture. O. B.

GILLBERG (MARIANNE). *Perite, a new oxyhalide mineral from Långban, Sweden*. Arkiv Min. Geol. Stockholm, 1960, **2**, 565-570, 3 tables.

A new mineral, *perite*, is reported from Långban, Sweden. It is orthorhombic pseudotetragonal, space group $D_{2h}^{17}\text{-Bmmb}$, cell dimensions a 5.627 ± 0.050 , b 5.575 ± 0.020 , c 12.425 ± 0.090 Å. The unit cell contains 4 formula units, its volume is 391 Å^3 . Atomic parameters z_{Pb} 0.385, z_{Bi} 0.090, z_{Cl} 0.75. The atomic distances are: Pb-4O 2.45 Å, Pb-4Cl 3.30 Å and 3.25 Å, Bi-4O 2.27 Å, Bi-4Cl 3.45 Å and 3.42 Å. A synthetic perite was prepared with cell dimensions a 5.593 ± 0.002 , b 5.558 ± 0.002 , c 12.428 ± 0.008 Å. Slight differences in the unit cell dimensions are probably due to impurities in the natural perite. Chem. analysis by A. Parwel gave PbCl₂ 26.33, PbO 23.69, Bi₂O₃ 45.74, MnO 0.46, CaO 1.44, MgO 0.07, CO₂ 1.19, H₂O+ 0.10, H₂O- 0.04, insol. 1.00, = 100.06, leading to the formula PbBiO_2Cl , which is analogous to nadorite, PbSbO_2Cl . H. ≈ 3 , sp. gr. 4.16, refr. ind. not det. but probably > 2.4 . Perite is a sulphur-yellow mineral with yellow streak and adamantine lustre. It occurs as an extremely rare fissure mineral in manganese skarn consisting essentially of hausmannite, calcite, and minerals of the ludwigite-vonsenite group. X-ray powder data are given; the strongest lines are 2.86 (10), 1.620 (9), 3.77 (8), 1.251 Å (8). The name is in honour of Prof. Per Geijer, Stockholm. [A.M. 46-765]

E. P.

LANDMETS (R.). *Orthopinakiolite, a new modification of $\text{Mg}_3\text{Mn}^{2+}\text{Mn}_2^{3+}\text{B}_2\text{O}_{10}$ from Långban, Sweden*. Arkiv Min. Geol. Stockholm, 1960, **2**, 551-555, 2 tables.

An orthorhombic modification of pinakiolite from Långban, Sweden, is reported to have the probable space groups $C_{2v}^{10}\text{-Pnn}2$ or $D_{2h}^{12}\text{-Pnnm}$, cell dimensions a 18.45 ± 0.3 , b 12.70 ± 0.2 , c 6.07 ± 0.1 Å; sp. gr. 4.03 ± 0.05 , $Z=8$. X-ray powder data are given; the strongest lines are 2.59 (10), 5.17 (9), 2.52 (9), 2.03 (9), 2.20 (8), 1.523 Å (8). [M.A. 11-242; A.M. 46-768] E. P.

WEET (J. M.). *Tacharanite and other hydrated calcium silicates from Portree, Isle of Skye*. Min. Mag., 1961, **32**, 745-753, 9 figs.

The vesicles of an olivine dolerite from a small outcrop near Portree contain mesolite, thomsonite, saponite, calcite, tobermorite, xonotlite, gyrolite, and *tacharanite*, presumed to be a new member of the tobermorite group. Tacharanite (A) occurs associated with tobermorite and is surrounded by a rim of gyrolite and mesolite: on exposure to air it breaks down to a mixture of tobermorite and gyrolite. The analysis indicates a formula $(\text{Ca}, \text{Mg}, \text{Al})(\text{Si}, \text{Al})\text{O}_3 \cdot \text{H}_2\text{O}$; it is almost isotropic. The X-ray powder pattern has strongest reflections at 12.7, 3.05, and 2.89 Å. The name is from the Gaelic *tacharan*, a changeling. Analyses are also given (all analyses by D. I. Bothwell) of xonotlite (B) and gyrolite (C) together with dehydration curves for these minerals: the xonotlite has refr. ind. ≈ 1.580 , begins to lose water at 820°C and is dehydrated completely at 1050°C; the gyrolite has ω 1.548. An attempt is made to account for the sequence of crystallization of the minerals.

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	Na ₂ O	K ₂ O	H ₂ O	Total
A	41.8	5.6	0.3	3.2	33.6	0.6	0.1	15.2	100.4
B	50.1	—	0.4	—	46.2	—	—	3.4	100.1
C	50.0	3.5	0.1	tr.	32.3	0.8	0.2	13.1	100.0

R. A. H.

GILLBERG (MARIANNE). *A lead-bearing variety of pargasite from Långban, Sweden*. Arkiv Min. Geol. Stockholm, 1959, **2**, 425-430, 6 tables.

An amphibole containing 2.12% PbO has been discovered from Långban, Sweden. It is a light-reddish mineral and occurs in manganophyllite skarn. Chemical analysis by R. Blix gave SiO₂ 43.08, Al₂O₃ 10.30, Fe₂O₃ 2.68, MgO 20.17, CaO 12.62, Na₂O 3.18, K₂O 0.30, H₂O+ 2.08, H₂O- 0.23, TiO₂ 0.15, MnO 3.24, PbO 2.12, = 100.15. Chemically it is very similar to tiberite except for the Pb-content, which in the original tiberite is 0.2 (spectrograph. anal.). Structurally the Pb-rich amphibole is monoclinic and its parameters are: a 9.89 ± 0.05 , b 18.10 ± 0.05 , c 5.35 ± 0.07 Å, β $106.1^\circ \pm 0.8^\circ$; space group $C2/m$. Sp. gr. 3.15 ± 0.01 , $2V_\gamma = 86^\circ \pm 4^\circ$, $c : \gamma = 27^\circ \pm 1^\circ$. Pleochroism faint; α pale reddish brown, γ pale brownish red; α 1.637, β 1.647, γ 1.657; ionic refractivities are tabulated. The Pb-amphibole seems to be a variety of pargasite. E. P.

ČECH (F.), POVONDRA (P.), & SLÁNSKÝ (E.). *Über Planerit aus Poniklá bei Jilemnice (Nordböhmen) und über die Beziehung zwischen Planerit, Coeruleolactit und Turkis*. Neues Jahrb. Min., Abhandl., 1961, **96**, 1-30, 3 figs., 2 pls.

Planerite from Poniklá, near Jilemnice, northern Czechoslovakia, previously described as turquoise, is established as a valid mineral species. It occurs with quartz and goethite. Chemical analysis by P. Povondra gave Al₂O₃ 32.70, CaO 0.14, CuO 8.25, P₂O₅ 30.71, H₂O 14.78, insol. 13.06, = 99.64, leading to the formula $\text{CuAl}_6(\text{PO}_4)_4(\text{OH})_8 \cdot 3.7\text{H}_2\text{O}$. The X-ray powder pattern has strongest reflections at 3.71 (10),

2.88 (9), and 6.81 (8) Å. Planerite is sky-blue, with refr. ind. 1.599 ⊥ fibre axis and 1.605 || fibre axis. The d.t.a. curve differs from that of turquoise in having an exothermic reaction at around 920°C (100° higher than that of turquoise); it also has endothermic peaks at 250° and 340°C. The X-ray pattern is similar to that of coeruleolactite from East Whiteland Township, Chester Co., Pennsylvania, but coeruleolactite from the type locality at Katzenellenbogen, Nassau, Germany, was not compared. [M.A. 1-262]

R. A. H.

[ANKINOVICH (E. A.)] Анкинович (Е. А.). Новый ванадиевый минерал — русаковит [A new vanadium mineral — rusakovite]. Зап. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1960, **89**, 440—447, 2 figs.

Rusakovite was discovered during 1955 in NW Karatau in coal-clay layers in Middle Cambrian shales. It occurs only in zones of incomplete oxidation, growing in cavities, along cracks and foliation planes as aggregates or concretions. It is often associated with colloidal phosphate, $6(\text{FeAl})_2\text{O}_3 \cdot \text{P}_2\text{O}_5 \cdot \text{aq}$. Rusakovite is yellow-orange (sometimes ochreous), H. 1.5–2, sp. gr. 2.73–2.8. Under the microscope the golden-yellow granules are weakly birefringent; refr. ind. 1.833. Electron micrographs show coarse lamellae with ragged edges. Chemical analysis (S. I. Potok) gives: MgO 1.40, CaO 0.30, Al_2O_3 5.00, Fe_2O_3 45.00, SiO_2 1.80, V_2O_4 5.00, V_2O_5 16.60, P_2O_5 6.50, SO_2 1.00, H_2O^+ 13.30, H_2O^- 5.00, =100.90; formula is $(\text{Fe,Al})_5[(\text{V,P})\text{O}_{12}](\text{OH})_6 \cdot 3\text{H}_2\text{O}$ ($\text{Fe:Al} \geq 4:1$; $\text{VO}_4:\text{PO}_4 \geq 2:1$). D.t.a. and X-ray data are given: the strongest powder lines are d 3.21 (10), 4.63 (9), 2.945 (9), 2.441 (8), 2.140 (7). Properties are compared with those of nolanite, montroseite and fervanite, from which rusakovite is distinct. The name is after the Kazakh geologist Mikhail Petrovich Rusakov. [A.M. 45-1316]

O. B.

[ERMILOVA (L. P.), MOLEVA (V. A.), & KLEVTSOVA (R. F.)] Ермилова (Л. П.), Молева (В. А.) и Клевцова (Р. Ф.). Чухровит — новый минерал из Центрального Казахстана [Chukhrovite—a new mineral from central Kazakhstan]. Зап. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1960, **89**, 15–25, 4 figs.

Chukhrovite was discovered in 1950 in the molybdenite-wolframite ore-veins of Karaob, Kazakhstan. It is a cubic hydrated sulphate-fluoride of Ca, Al, and rare-earths. The crystals are small (<1 cm) cube-octahedra, colourless or white-porcellanous, sometimes with a marked lilac tinge. Fracture uneven, H. 3, indistinct octahedral cleavage; rarely granular. Sp. gr., by heavy liquids 2.353 (mean of 7), by X-ray 2.34; n 1.43. The crystals are anomalously anisotropic; microscopic zoning is due to minute liquid

inclusions. Analysis (mean of two) gives CaO 20.16, Al_2O_3 12.01, TR_2O_3 19.62, SO_3 9.57, F 29.55, H_2O 21.53, —O=H 12.44, =100; formula $\text{Ca}_3\text{Al}_2\text{TR}(\text{SO}_4)\text{F}_{13} \cdot 10\text{H}_2\text{O}$. X-ray data, d.t.a. curves, and analysis of rare-earths are provided: a 16.80 Å. Strongest powder lines are d 2.193 (10), 1.834 (10), 3.261 (9), 2.572 (9), 2.294 (9), 2.843 (8), 1.684 (8), 1.512 (8), 1.460 (8), 1.417 (8). Bøggild [M.A. 12-199] has described a similar (but unnamed) cubic mineral from Greenland. The name is after the mineralogist F. V. Chukhrov who first worked on these ores. Associated fluorite contains up to 3% TR_2O_3 . [A.M. 45-1132].

O. B.

MÜLLER (G.). Vorläufige Mitteilung über ein neues dioktaedrisches Phyllosilikat der Chlorit-Gruppe. Neues Jahrb. Min., Monatshefte, 1961, 112–120, 4 figs.

A new layer silicate with alternating pyrophyllite and gibbsite layers in the c direction, representing a dioctahedral member of the chlorite group, occurs as an alteration product in hydrothermally altered Permian quartz porphyry tuffs of Kesselberg district, near Triberg, Schwarzwald, southern Germany. It has a 5.14, b 8.95 Å; d_{001} 14.22 Å, α 1.574, $\beta = \gamma$ 1.580, $2V_\alpha$ small. Chemical analysis of the light-coloured aggregate (95% of the colourless, pseudo-hexagonal prismatic crystals with worm-like habit together with 5% quartz and hematite) gave SiO_2 45.93, Al_2O_3 35.33, Fe_2O_3 3.34, FeO tr., CaO 0.0, MgO 0.0, Na_2O 0.0, K_2O 3.95, H_2O^+ 8.73, H_2O^- 2.27, =99.75, indicating an $\text{SiO}_2:\text{Al}_2\text{O}_3$ ratio of 2:1. This 'Al-chlorite' is thus con-

sidered to have an ideal formula $\left\{ \begin{array}{c} \text{Al}_2[(\text{OH})_2\text{Si}_4\text{O}_{10}] \\ \text{Al}_2(\text{OH})_6 \end{array} \right\}$.

R. A. H.

[BONSHTEDT-KUPLETSKAYA (É. M.)] Бонштедт-Куплетская (Э. М.). Новые минералы. IX [New minerals. IX]. Зап. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1960, **89**, 63–81.

Among the minerals listed in this article the following have not as yet been recorded in *Mineralogical Abstracts*:

JOHAN (Z.) & HAK (J.). *Novákite* $(\text{Cu,Ag})_4\text{As}_3$, ein neuer Mineral. Chemie der Erde, 1959, **20**, 49–50.

(Preliminary communication.) *Novákite*, $(\text{Cu,Ag})_4\text{As}_3$ is tetragonal with a 8.206, c 11.88 Å; $a:c$ 1:1.448. No cleavage; H. 3–3½; sp. gr. (impure material) 6.7. Steel grey on fractured surface, blackens in air; white in reflected light; it has a higher reflectance than native As and a yellow tinge; anisotropic from dark blue-grey to brown. Attacked by HNO_3 (1:1), HCl (1:1), and FeCl_3 (20%). Analysis (allowing for impurities), Cu 50.91, Ag 3.27, As 45.82%. Disintegrates and melts when heated. Novákite occurs (with chalcocite and löllingite) as impregnations in carbonate rocks in Cu-Co-As ores in Kutná Hora

zechoslovakia. It weathers readily to secondary Cu and S minerals. Strongest lines of powder photographs: 1-870 and 1-182 (10), 1-998 and 1-957 (9), 1-910 (7), 1-352 and 1-225 (6), 1-787 (5). Named after the Prof. J. Novák, Charles University, Prague. [A.M. 44-1321]

ITARO (H.). *Minerals of bismuthinite-stibnite series with special reference to horobetsuite from the Horobetsu mine, Hokkaido, Japan*. Min. Journ. [Japan], 1955, **1**, 189-197.

Horobetsuite (Bi,Sb) S_3 is intermediate between stibnite and bismuthinite. Orthorhombic, a 11.21, b 11.25, c 9.90 kX; $a:b:c=0.996:1:0.346$. Prismatic crystals are elongated along c axis, vertically striated; $H \approx 2$; steel-grey (streak black); anisotropic in reflected light; sp. gr. 4.49. It is turned brown by HNO_3 (1:1), HCl (1:1), I_2Cl_2 (5%), and $FeCl_3$ (20%). Analysis of two specimens by S. Ito gave Bi 56.93, 44.80, Sb 21.49, 32.30, S 21.57, 3.00, Fe tr., insol. res. tr., 0.05, =99.99, 100.15. Ratio $Bi_2S_3:Sb_2S_3$ varies from 9:11 to 13:17. Horobetsuite occurs in the sulphide ores of Horobetsu—hence the name. [A.M. 43-623]

AEES (J. F.). *Cousiniet, ein nieuw uraanmineral*. Geol. en Mijnbouw, 1958, **20**, 449.

Cousinite, $MgO \cdot 2MoO_3 \cdot 2UO_2 \cdot 4$ or $6H_2O$, occurs as fine black platelets, with glassy lustre, intergrown in parallel or fan-like aggregates. U, Mo, Mg, H_2O , and absence of Pb were determined microchemically on selected material. Composition—less admixed wolframite (7.11%) and insol. residue—is UO_2 58.10, MoO_3 27.17, MgO 4.31, H_2O 10.42, =100.00 (on 270 mg.). On heating to 200°C it changes colour and weight increases (3.27%). Cousinite is found in the wolframite ores of Shinkolobwe, Katanga, Congo. [A.M. 44-910]

CKIE (D.). *Notes on some minerals from Tanganyika*. Rec. Geol. Surv. Tanganyika, 1955 (1958), **5**, 81-99.

Tangaite is proposed for the aluminium end-member ($AlPO_4 \cdot 2H_2O$) of the isomorphous 'redontite series'. The interplanar distance (and presumably structure) of this series has not yet been shown to differ significantly from that of the variscite-strengite series—hence the name is proposed provisionally. [A.M. 45-910]

RAITSCH (O.). 1 *Tc-Strontiohilgardit* $(Ca,Sr)_2[B_5O_8(OH)_2Cl]$ und seine Stellung in der Hilgarditgruppe $X_2^{++}[B_5O_8(OH)_2Cl]$. Beitr. Min. Petr., 1959, **6**, 233-247, 7 figs.

1 *Tc-Strontiohilgardite* has Ca:Sr—1:1. Crystals are 1-0.2 mm long, 0.25-0.35 mm wide, 0.1-0.02 mm thick (max. $2 \times 1 \times 0.5$ mm). Triclinic monohedral, C_2^1-P1 ,

a 6.38, b 6.480, c 6.608 Å; α 75.4°, β 61.2°, γ 60.5°; $a:b:c=0.9845:1:1.0198$; Z 1. Left and right-handed crystals occur. Forms (in order of decreasing importance): (010), (0 $\bar{1}$ 0), (0 $\bar{1}\bar{1}$), ($\bar{1}$ 01), (111), (001), ($\bar{1}$ 00), (120), (100), and rarely (00 $\bar{1}$); crystals are tabular on (010), rarely columnar. Small deviation from tetragonal symmetry, a is pseudo-tetragonal axis. (001) cleavage good, (211) distinct, (010) possible. H 5-7; sp. gr. (Sr:Ca=1:1) 2.993, by X-ray 3.023. The mineral is in colourless or pale yellow crystals with glassy lustre; piezoelectric; γ' 1.670, α' 1.638 (λ 500 m μ); 2V, 19°. O.A.P. inclined at 12° to (010); one optic axis almost || to [100]. Insoluble in water. Composition, by spectral anal., CaO 15-20, SrO 20-25, B_2O_3 40-45, Al_2O_3 0.2, MgO 0.1%; by standard methods, Cl 8.2, H_2O 5.3%. Main lines of powder diagram, 2.89, 2.82, 2.775, 2.142-2.137, 2.053. The mineral occurs in sylvinite rocks of Reyershausen near Göttingen.

2 *M(Cc)-Calciumhilgardite* is name proposed for hilgardite with formula $Ca_2[B_5O_8(OH)_2Cl]$. Monoclinic, with a 6.31, b 11.33, c 11.44 Å (a and c axes [A.M. 22-1052] have been interchanged), β 90°00'. Space group C_2^4-Cc ; $Z=4$.

Tc-Calciumhilgardite is a new name proposed for parahilgardite. Formula see above; triclinic, C_1^1-P1 , a 6.31, b 6.484, c 17.50 Å; α 84.0°, β 79.6°, γ 60.9°, $Z=3$. [A.M. 44-1102]

NOTE.—Such complex names are inconvenient in use and difficult to interpret. Names hilgardite and parahilgardite should be retained for calcium members of the group. [É.M.B.-K.]

KALPADY (S.) & DAVE (A. S.). *On mangan-uralite from Ponia, Balaghat District, Madhya Pradesh*. Journ. Univ. Geol. Soc. Nagpur, 1958 (1955-56), **1**, 4-7.

Mangan-uralite is a rose-coloured amphibole formed by the alteration of blanfordite in a pegmatite at Ponia. Monoclinic, $2V_\alpha$ large, α 1.65-1.66, β 1.66-1.67, γ 1.66-1.67; pleochroic, α rose, β pale brown to yellow, γ blue. Composition: SiO_2 55.35, Al_2O_3 3.52, Fe_2O_3 12.21, MgO 14.54, MnO 3.08, CaO 2.17, Na_2O 7.44, K_2O tr., H_2O 2.90, =101.21. [Fleischer [A.M. 44-692] comments that the name is awkward and unnecessary.]

NOVÁK (F.), VTELENSKY (J.), LOSERT (J.), KUPKA (F.), & VALCHA (Z.). *The orthochamosite from the ore veins of Kank near Kutná Hora—a new specific mineral*. Fr. Slavík Memorial Vol., Czech Acad. Sci., 1957, 315-344.

Orthochamosit, ein neues Mineral aus den hydrothermal Erzgängen von Kank bei Kutná Hora (Kuttenberg) in der Tschechoslowakei. Geologie, 1959, **8**, 159-167.

Orthochamosite : orthorhombic chamosite occurs as earthy grey-green masses in ore-vein fractures and also as spherulitic pseudomorphs (after pyrite?). *a* 5·355, *b* 9·239, *c* 7·043 kX; sp. gr. 3·078. Under the microscope appears as minute anisotropic flakes with mean n_{Na} 1·649. Composition : SiO_2 26·01, Al_2O_3 12·33, Fe_2O_3 5·23, FeO 37·07, CaO 0·48, MgO 6·13, MnO 0·04, $H_2O +$ 10·33, $H_2O -$ 2·03, = '99·74'. Water is given off from 350° to 600°C. D.t.a. shows endothermal maxima at 120° and 550°C and exothermic at 370° (oxidation of FeO). Orthochamosite is formed by the ageing of gels; incomplete crystallization is shown by the diffuse X-ray lines. Most intense lines : 7·17 (10), 3·52 (8), 1·549 (6), 2·500 (5), 1·513 (4). [A.M. 43-792]

KUBISZ (J.). *Minerals of the hexahydrate group from Boleslaw near Olkusz*. Bull. Acad. Polon. Sci., sér. sc. chim., géol., geogr., 1958, **6**, 459-463.

Magnesio-hexahydrate is the name proposed for $MgSO_4 \cdot 6H_2O$. The term hexahydrate should be retained for the group of hexahydrate sulphates, with end members $ZnSO_4 \cdot 6H_2O$ (zinc-hexahydrate) and $FeSO_4 \cdot 6H_2O$ (ferro-hexahydrate). Intermediate members are $(Zn,Fe)SO_4 \cdot 6H_2O$ (zinc-ferro-hexahydrate (bianchite), $(Zn,Fe,Mg)SO_4 \cdot 6H_2O$ (zinc-ferro-magnesio-hexahydrate, and so on. O. B.

See also : GUTT (W.), *A new calcium magnesiosilicate* on p. 276; FLINTER (B. H.), *The alteration of Malayan ilmenite grains*, on p. 299.

PHYSICAL PROPERTIES OF MINERALS

NAGASAWA (KEINOSUKE). *Differential thermal analysis studies on the high-low inversion of vein quartz in Japan*. Journ. Earth Sci. Nagoya Univ., 1953, **1**, 156-176, 6 figs.

D.t.a. curves of twenty-one quartz specimens from various sources in Japan show considerable variation. In general quartz from high temperature deposits yields simple and sharp peaks, that from low temperature deposits broad peaks. Interpretation of the differences and of the areas under the peaks is considered. A. P.

D'ALBISSIN (MICHELINE), SAPLEVITCH (ALEXANDRE), & SAUCIER (HENRI). *Etude par la méthode dilatométrique de la déformation des roches calcaires*. C.R. Acad. Sci., Paris, 1960, **251**, 2995-2997.

The variations of the dilatation coefficients of calcareous rocks, like diagrams obtained by B. Sander's optical method, reflect the preferential orientation of the optical axes of calcite crystals in relation to deformation.

E. J. & A. S.

WALTON (MATT. [S.]). *Molecular diffusion rates in supercritical water vapour estimated from viscosity data*. Amer. Journ. Sci., 1960, **258**, 385-401, 5 figs., 1 table.

Recent theoretical and experimental results are used to extrapolate values for the viscosity of supercritical water vapour up to 800°C and 2500 kg cm⁻² pressure. The viscosity values obtained are applied to the Stokes-Einstein equation of diffusivity of a particle in a gas, and the diffusivity of silica in supercritical water in this range of *P-T* conditions is calculated. The results indicate that mass transport of silica by diffusion through intergranular spaces in rocks containing supercritical water vapour is potentially a relatively rapid geological process.

J. A. S.

ROBERTSON (FORBES). *Knoop hardness numbers for 127 opaque minerals*. Bull. Geol. Soc. America, 1961, **72**, 621-638.

The average and the range of Knoop hardness numbers are given for 127 opaque minerals and quartz. A. L. A.

MOKIEVSKIĬ (V. A.). *Dependence of the form of indentation on the symmetry of the crystal faces in the determination of hardness by penetration of a diamond pyramid*. Soviet Physics : Crystallography, 1960, **4**, 381-384, 5 figs. Translated from Kristallografiya, 1959, **4**(3), 410-413.

On the basis of the symmetry of the diamond pyramid and of the crystal faces, all the possible classes of symmetry of indentations are derived, and many of them are confirmed experimentally. A. P.

BOIARSKAYA (YU. S.). *Investigation of the anisotropy of hardness of single crystals of PbS by scratching*. Soviet Physics : Crystallography, 1957, **2**, 702-705, 4 figs., 2 tables. Translated from Kristallografiya, 1957, **2**(5), 709-712.

Hardness rosettes are pictured for (100), (110), and (111) faces. The influences of the sense in which the scratch is directed and of previous polishing of the surface to be scratched are investigated. A. P.

GRÖGLER (N.) & STEIGER (R.). *Thermolumineszenz-Erscheinungen an Hornblenden der Tremolaserade*. Schweiz. Min. Petr. Mitt., 1961, **41**, 11, [summary of conference].

The glow-curves of 15 amphibole samples separated from crystalline schists are discussed. M. W.

PLIUSNINA (I. I.) & BOKIĬ (G. B.). *The infrared reflectivity spectra of the cyclosilicates in the wavelength interval from 7 to 15 μ*. Soviet Physics : Crystallography, 1960, 761-764, 3 figs. Translated from Kristallografiya, 1958, **3**(6), 752-756.

Curves for the reflection spectra are reproduced for catapleiite, eudialyte, diopside, cordierite, vorobyevite, quartz, beryl, and tourmaline and for the absorption spectrum of milarite. No information is provided about the specimens used. A. P.

ALLAN (ALLAN). *Anomalous remanent magnetization of basalt*. Bull. U.S. Geol. Survey, 1961, **1083-E**, 131-160.

Lightning is probably the most common cause of anomalous magnetization in the lava flows of Idaho.

K. S.

NAGATA (T.), YAMA-AMI (M.), & AKIMOTO (S.). 'Memory' of initial remanent magnetization and number of repeating of heat treatments in low-temperature behaviour of haematite. Nature, 1961, **190**, 620-621, 2 figs.

M. J. LE B.

KAWAI (NAOTO). *Magnetism of rocks and solid phase transformation in ferromagnetic minerals. III.* Proc. Japan Acad., 1955, **31**, 346-351, 15 figs., 2 tables.

Thermo-magnetic curves are pictured for 15 titaniferous magnetites, some with stable and some with unstable magnetization, with 8 to 30 mol% TiFe_2O_4 , separated from Upper Miocene rocks of the Boso district, Japan. It is concluded that among these samples low Curie points can be correlated with unstable magnetization. A. P.

KUME (SHOICHI). *On some magnetic properties of ilmenite at low temperatures*. Proc. Japan Acad., 1955, **31**, 709-712, 2 figs., 1 table.

Thermomagnetic measurements have been carried out on 2 synthetic members of the mixed crystal series Fe_2O_3 - FeTiO_3 , down to boiling nitrogen temperature. The intensity of the magnetization increases as the temperature of the Curie point and the ferric iron concentration in the material decrease. A. P.

KAWAI (NAOTO), KUME (SHOICHI), & YASUKAWA (KATSUMI). *Exsolution of titanomagnetite and its time effect on rock-magnetism. I. Change of exsolution phase with geological age*. Proc. Japan Acad., 1956, **32**, 455-458, 3 figs., 1 table.

The remanent magnetism, intensity of saturation magnetization, and the dependence of these values on temperature have been determined for about 400 samples of titanomagnetite from effusive rocks in Japan. Thermo-magnetic analyses and the relation of the weight per cent of ulvöspinel to the Curie point are shown graphically for 4 age groups: 'present' (meaning 20th century), 'historical' (1470 to 1788), 'quaternary', and 'Tertiary'. The dependence of exsolution on age and the effect of this on the Curie point are shown by a three dimensional phase distribution surface. A. P.

KAWAI (NAOTO), KUME (SHOICHI), & SASAJIMA (SADAO). *Exsolution of titanomagnetite and its time effect on rock-magnetism. II. Correlation between rock-magnetism and exsolution phase*. Proc. Japan Acad., 1956, **32**, 459-463, 8 figs.

The findings reported in the first report [preceding abstract] are applied in a discussion of rock magnetism. There is reference to 'repeated inversions of direction of magnetization' within a single specimen. A. P.

KAWAI (NAOTO). *Exsolution of titanomagnetite and its time effect on rock-magnetism. III. Effects of enduring temperature and slow cooling*. Proc. Japan Acad., 1956, **32**, 464-468, 2 figs.

The relation of thermo-remanent magnetism to the temperature of exsolution and the Curie points of the phases formed is discussed. A. P.

NAGATA (TAKESHI) & KOBAYASHI (KAZUO). *Experimental studies on the generation of remanent magnetization of ferromagnetic minerals by chemical reactions*. Proc. Japan Acad., 1959, **34**, 269-273, 3 figs.

Reduction of α - Fe_2O_3 powder ($<1\mu$) to Fe_3O_4 by hydrogen at 340°C under the influence of a magnetic field varying from 0.5 to 40 Oe. is nearly complete in 20 hours. Magnetic observations on this material lead to the conclusion that 'remanent magnetization, of which intensity is intermediate between isothermal remanent magnetization and thermo-remanent magnetization, can be generated by chemical reaction from α - Fe_2O_3 to Fe_3O_4 under the influence of a magnetic field'. A. P.

ZHELUDEV (I. S.). *Symmetry and piezoelectric properties of crystals and "textures"*. Soviet Physics: Crystallography, 1957, **2**, 86-94, 5 figs. Translated from Kristallografiya, 1957, **2**(1), 89-98.

A theoretical discussion. Piezoelectric polarization in crystals and in textures is associated with special polar directions, either those already present or those arising due to mechanical action. The change in symmetry due to mechanical action is considered and it is shown that under certain conditions piezoelectric polarization can be brought about in crystals in class 432. It is assumed that absence of a symmetry centre in crystals or textures may serve as a necessary and sufficient indication for classifying them as possibly piezoelectric. A. P.

TAVGER (B. A.). *The symmetry of ferromagnetics and anti-ferromagnetics*. Soviet Physics: Crystallography, 1958, **3**, 341-343. Translated from Kristallografiya, 1958, **3**(3), 339-341.

The classes of magnetic symmetry admitting spontaneous

macroscopic magnetization are derived. The phenomenon of weak ferromagnetism of antiferromagnetics is discussed from the point of view of magnetic symmetry. It is stated that 'Time inversion reverses the direction of spin'. [See following abstracts] A. P.

TAVGER (B. A.). *Symmetry of piezomagnetism of antiferromagnetics*. Soviet Physics : Crystallography, 1958, **3**, 344-347. Translated from Kristallografiya, 1958, **3**(3), 342-345.

Sixteen possible types of 'tensors' of piezomagnetic moduli are found. It is shown that piezomagnetism is forbidden in those classes of magnetic symmetry which contain the operation of inversion of space and time coordinates and in classes $\bar{4}3m$, 43 and $m3m$. [See following abstract] A. P.

SHUBNIKOV (A. V.). *Time reversal as an operation of antisymmetry*. Soviet Physics : Crystallography, 1960, **5**, 309-314, 1 fig. Translated from Kristallografiya, 1960, **5**(2), 328-333.

The difference between magnitudes with and without sign is discussed. As a magnitude without sign, time cannot change its sign. As an operation of antisymmetry, therefore, time reversal is meaningless. In the magnetic symmetry groups of crystals, the operation of anti-identity is performed by a change in direction of current, which bears no relation to time reversal. [See preceding abstracts] A. P.

NAROVSKAYA (N. P.). *Magnetic anisotropy and crystal structure of a single crystal of magnetite at temperatures below the phase transition*. Soviet Physics : Crystallography, 1958, **3**, 348-351, 6 figs. Translated from Kristallografiya, 1958, **3**(3), 346-350.

A magnetite monocrystal cooled in a strong magnetic field to below the temp. of transition (-160°C) acquires one axis of easy magnetization. At the same time its crystal structure changes to orthorhombic [M.A. **12**-318]. The c axis of the orthorhombic crystal coincides with that edge of the initial isometric lattice which is nearest to the direction of the field during cooling. This is the axis of easiest magnetization. The a and b axes coincide with the diagnosis of the initial cube face normal to c . A. P.

BELOV (K. P.) & ZALESSKIĬ (A. V.). *Thermal expansion and magnetostriction of pyrrhotite*. Soviet Physics : Crystallography, 1958, **3**, 390-392, 2 figs. Translated from Kristallografiya, 1958, **3**(3), 388-390.

The coefficients of expansion, specific magnetization, and magnetostriction of pyrrhotite have been determined as functions of temperature over the range about 0° to 350°C .

Anomalies in these functions lead to the conclusion that the energy of ordering of vacancies is greater than the energy of ordering of spins. The character of the material examined is not reported. A. P.

VORONKOV (A. A.). *The piezoelectric, elastic, and dielectric properties of crystals of $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$* . Soviet Physics : Crystallography, 1960, **3**, 722-725, 4 figs. Translated from Kristallografiya, 1958, **3**(6), 716-719.

The temperature dependence of the constants has been determined by the dynamic method in the region of room temperature. Artificial crystals used were grown from an aqueous solution containing 0.06% borax. The principal forms are {110}, {111}, and {010} with minor {101}, {011}, {100}, {211}, and {121}. A. P.

KOPTSIK (V. A.) & KOBYAKOV (I. B.). *The dielectric piezoelectric and elastic parameters of cancrinite crystals*. Soviet Physics : Crystallography, 1960, **4**, 201-203, 1 fig. Translated from Kristallografiya, 1959, **4**(2), 223-225.

The material used is referred to as being of poor quality. source or composition is not reported. The parameters were determined by dynamic methods. The piezoelectric activity of cancrinite is substantially higher than that of quartz. The macroscopic symmetry of cancrinite is discussed. A. P.

SHUVALOV (L. A.). *Ferromagnetic phase transitions and the symmetry of crystals*. Soviet Physics : Crystallography, 1960, **4**, 371-380. Translated from Kristallografiya, 1959, **4**(3), 399-409.

The change in point crystallographic and magnetic symmetry in all classes of crystals with possible ferromagnetic phase-transitions is discussed and fully tabulated. [See following abstract] A. P.

NERONOVA (N. N.) & BELOV (N. V.). *Ferromagnetic and ferroelectric space groups*. Soviet Physics : Crystallography, 1960, **4**, 769-774. Translated from Kristallografiya, 1959, **4**(6), 807-812.

In two extended tables the international symbols for the 275 ferromagnetic and the 275 ferroelectric space groups are arranged according to the corresponding 31 Shubnikov point groups. A. P.

SONIN (A. S.) & ZHELUDEV (I. S.). *Space groups and ferroelectric phase transitions*. Soviet Physics : Crystallography, 1960, **4**, 460-469. Translated from Kristallografiya, 1959, **4**(4), 487-497.

It is shown that the space group changes according to a strictly defined law in a ferroelectric transition. The

relations are set forth for all 230 space groups in 6 tables ; 3 examples are enumerated in another table. A. P.

VINOKUROV (V. M.). *On the nature of the magnetic properties of siderite, ankerite and rhodochrosite*. Soviet Physics : Crystallography, 1959, **3**, 606-610. Translated from Kristallografiya, 1958, **3**(5), 600-604.

Magnetic properties are reported for 12 specimens of siderite, 17 of ankerite, and 4 of rhodochrosite. The first two minerals are magnetically markedly anisotropic, the latter magnetically almost isotropic. A. P.

VINOKUROV (V. M.) & ZARIPOV (M. M.). *The magnetism of tourmaline*. Soviet Physics : Crystallography, 1960, **4**, 828-831. Translated from Kristallografiya, 1959, **4**(6), 873-877.

The magnetic properties of tourmaline are reported for a total of 28 specimens grouped in three tables for black, green, and rose-coloured tourmalines respectively.

A. P.

POWERS (D. A.) & JOHANSEN (I. J. T.). *Electric strength of rutile single crystals*. Journ. Appl. Phys., 1961, **32**, 1083-1085, 7 figs.

The breakdown strength of rutile crystals was measured parallel and perpendicular to the optic axis. It was observed that the dc breakdown is a thermal process occurring at a power level of 2 kw/cm² for the particular sample size and test cell used in this work, with field strengths of 20 kv/cm parallel to the axis and 120 kv/cm perpendicular to the axis. Impulse measurements at 1

micro sec. rise time required special techniques of sample and electrode preparation in order to prevent field distortion and surface breakdown. Breakdown strengths of 570 kv/cm perpendicular and 690 kv/cm parallel to the optic axis were measured.

R. G. Wls.

GREENER (E. H.) & WHITMORE (D. H.). *Nonohmic behaviour in near-stoichiometric rutile (TiO₂)*. Journ. Appl. Phys., 1961, **32**, 1320-1324, 7 figs.

Experimental observations of the isothermal current-voltage relationships in rutile over the temperature range 632-908°C have shown that currents in excess of ohmic currents can be drawn through small, single crystals of near-stoichiometric composition. These currents have been identified as space-charge-limited currents analogous to those observed in a vacuum diode. An increase in the ambient specimen temperature displaces the potential for transition from ohmic to nonohmic behaviour to greater values, so that at 908°C near-stoichiometric rutile exhibited only ohmic currents even at the largest fields employed.

R. G. Wls.

TRUETT (R.). *Influence of deformation and temperature on the cobalt gamma irradiation of sodium chloride. Evidence for electrical interaction between dislocations and point defects*. Journ. Appl. Phys., 1961, **32**, 1601-1604, 4 figs.

Ultrasonic attenuation measurements were used to study the influence of plastic deformation and of temperature on the attenuation gamma irradiation behaviour in sodium chloride.

R. G. Wls.

ROCK-FORMING MINERALS AND PETROLOGY

Rock-forming minerals

MIYAKAWA (TOSHIMICHI). *High-low inversion point of quartz in metamorphic rocks*. Journ. Fac. Sci. Tokyo Univ., 1954, **9**, 193-200, 1 fig., 4 tables.

The inversion points of quartz in metamorphic rocks ranging from the amphibolite to green-schist facies and also in recrystallized xenoliths in volcanic rocks were measured. The quartz formed at higher metamorphic grades has lower inversion points than that formed at lower grades. Quartz in xenoliths has lower inversion points than quartz from metamorphic and granitic rocks but higher than the inversion points of quartz from volcanic rocks. Conditions attending recrystallization of quartz in xenoliths are discussed.

A. P.

MIYAKAWA (KUNIHICO). *Graphic intergrowth of quartz and orthoclase found in a veined phyllite near a hornblende-quartz diorite mass, Wakasa-machi area*. Journ. Earth Sci. Nagoya Univ., 1958, **6**, 143-156, 8 figs., 2 pls.

The intergrowth shows no definite crystallographic relation between its constituents. Despite well-developed cuneiform sections the quartz rods are not bounded by crystal faces. The proportion of quartz in the intergrowth is rather constant at about 26.3% by vol. Conditions for the formation of this intergrowth in the phyllite are discussed.

A. P.

SCHERMERHORN (L. J. G.). *Orthoclase, microcline and albite in granites*. Schweiz. Min. Petr. Mitt., 1961, **41**, 13-36.

It is concluded that the existence of primary microcline in granites remains unproved. Probably all microcline in

granites is of monoclinic ancestry. The albite in albite granites is postmagmatic. Precambrian granites do not seem to be significantly different from younger granites. [M.A. 15-221] M. W.

MARMO (V.). *On the paper 'Orthoclase, microcline and albite in granites' by L. J. G. Schermerhorn.* Schweiz. Min. Petr. Mitt., 1961, **41**, 37-40.
A reply [preceding abstract]. M. W.

SLAWSON (W. F.) & NACKOWSKI (M. P.). *Trace lead in potash feldspars associated with ore deposits.* Econ. Geol., 1959, **54**, 1543-1555, 2 tables, 3 figs.

The lead content of potassium feldspars separated from several quartz monzonite intrusives of the Basin and Range province have been determined spectrochemically. A distinct trace lead population characterizes each district sampled. The trace lead content of potash feldspars is higher in lead mining districts than in unproductive areas; and hydrothermally altered intrusives contain less lead than spatially related unaltered intrusives. J. T. W.

WENK (E.). *Neue Aspekte der Plagioklasoptik.* Schweiz. Min. Petr. Mitt., 1961, **41**, 7-8, [summary of conference].

The paper deals with the optical orientation of high temperature plagioclases in the range 35-100% An. Attention is drawn to the fact that Fedorov already in 1898 showed that the migration curves of the plagioclases coincide with small circles. M. W.

RITTMANN (A.) & EL-HINNAWI (E. E.). *The application of the zonal method for the distinction between low- and high-temperature plagioclase feldspars.* Schweiz. Min. Petr. Mitt., 1961, **41**, 41-48, 4 figs.

The authors propose a supplementary operation to the zonal method which, with the aid of two nomograms, permits rapid distinction between low- and high-temperature plagioclases. M. W.

GOTTARDI (G.). *Ein neues Diagramm zur Bestimmung der Plagioklase mit Hilfe der Euler-Winkel.* Schweiz. Min. Petr. Mitt., 1961, **41**, 49-52, 1 fig.

A new diagram is proposed which allows a simple deduction of both composition and thermal state of a plagioclase from knowledge of its Euler angles. M. W.

WENK (E.), GRÜTTER (O.), & SCHWANDER (H.). *Labradorit aus Plateaubasalt von Ostgrönland.* Schweiz. Min. Petr. Mitt., 1961, **41**, 53-63, 1 fig.

Very weakly zoned labradorite phenocrysts of an olivine-

bearing basalt are optically and chemically investigated. The composition is 1.2 mol% Or, 32.5 Ab, 66.0 An, 0.3 Sr-feldspar. M. W.

SUWA (KANENORI). *Plagioclase twinning in Ryoke metamorphic rocks from the Mitsue-mura area, Kii peninsula, central Japan.* Journ. Earth Sci. Nagoya Univ., 1956, **4**, 91-122, 13 figs., 1 map, 3 pls.

The distribution of various kinds of twinning in plagioclase as a function of composition and rock-type has been determined by examination of 230 specimens on the universal stage. All plagioclases in the metamorphic complex are of low-temperature type. A. P.

DEICHA (G.). *Influence du degré de déséquilibre cristallogénétique sur la structure, la composition chimique et l'architecture des feldspaths.* C.R. somm. Soc. géol. France, 1960, **6**, 157-158.

Magmatic superfusion and supersaturation of solutions may affect the para- and metagenetic formation of twins. E. J. & A. S.

JÄGER (E.), KEMPTER (E.), NIGGLI (E.), & WÜTHRICH (H. M.). *Biotit-Varietäten und Stilpnomelan im alpin metamorph überprägten Mittagfluh-Granit (Aarmassiv).* Schweiz. Min. Petr. Mitt., 1961, **41**, 117-126.

The Mittagfluh granite is believed to be of Hercynian age. There are green, brown, and yellow varieties of biotite, in addition to stilpnomelane in the granite. The green and yellow types and the stilpnomelane are products of Alpine metamorphism. M. W.

BROWNLOW (ARTHUR H.). *Variation in composition of biotite and actinolite from monomineralic contact bands near Westfield, Massachusetts.* Amer. Journ. Sci., 1961, **259**, 353-370, 6 figs., 4 tables.

Thin lenses of serpentinite, amphibolite, and impure marble are intercalated with steeply dipping pelitic schists. The assemblage has been intimately intruded by quartz diorite; monomineralic bands of biotite and actinolite, from less than one inch to more than one foot in width, have developed parallel to the intrusive contact, biotite being next to the intrusive rock. Twelve samples of biotite and seven samples of actinolite, purified by repeated magnetic separation, have been analyzed, in duplicate, by rapid analysis methods, along with standards G-1, W-1, and aplogranite. Large variations in the major constituents were detected: in biotite—SiO₂ 37.93-42.05%, Al₂O₃ 14.26-19.22%, FeO 2.90-7.96%, Fe₂O₃ 1.13-3.04%, MgO 17.98-24.42%, and K₂O 8.96-10.31%; in actinolite—SiO₂ 51.33-58.34%, Al₂O₃ 0.02-7.70%, FeO 2.28-3.90%,

Fe_2O_3 0.56–1.74%, MgO 19.49–24.90%, and CaO 10.04–13.34%. The variations in the $\text{Mg}/(\text{Mg}+\text{Fe})$ ratios in the two minerals indicate that there was chemical disequilibrium in the bands.

R. M. B.

VISTELIUS (ANDREW B.) & SARMANOV (OLEG V.). *On the correlation between percentage values. Major component correlation in ferromagnesian micas.* Journ. Geol., 1961, **69**, 145–153, 2 tables.

To put the amounts of metallic elements in a series of mica analyses from the literature on a comparable basis, they are divided by the percentage of oxygen, which may be assumed as a constant. A negative correlation is found for Mg with Ti, Fe^{3+} and Fe^{2+} ions in six-fold coordination while a positive is found for Fe^{3+} ion with Ti and Al in four-fold coordination and for K with Al in four-fold coordination.

R. E. W.

STEIGER (R.). *Die Hornblende der Tremolaserie. Teil I. Chemismus und Dichte der Hornblendens.* Schweiz. Min. Petr. Mitt., 1961, **41**, 127–156, 1 fig.

Chemical composition and density of 15 rock-forming hornblendes of the Tremola series on the south border of the Gotthard massive are reported. The rocks are low to middle-grade metamorphic Pretriassic sediments. The techniques of separation, chemical analysis, and density measurement are described in detail.

M. W.

MATSUMOTO (HATAO). *Pargasite from Ishigamiyama, Kumamoto Prefecture.* Kumamoto Journ. Sci., ser. B, 1954, **1**, no. 4, 93–95.

The reddish brown pargasite occurs in 1–3 mm needles with tridymite and cristobalite in joints in andesite. Optical properties and chemical analysis repeat the values already reported [M.A. 12–375].

A. P.

YAMAOKA (KAZUO). *On the textures of the system magnetite–hematite–ilmenite in some volcanic and metamorphic rocks.* Kumamoto Journ. Sci., ser. B, sect. 1, 1958, **3**, no. 1, 39–49, 2 figs., 3 pls.

Opaque oxides were studied microscopically in volcanic rocks from 7 localities on Kyushu and in schists from 3 localities on Shikoku. Exsolution textures were found in all of the volcanic rocks but in only one of the schists.

A. P.

FLINTER (B. H.). *The alteration of Malayan ilmenite grains and the question of "arizonite".* Econ. Geol., 1959, **54**, 720–729, 4 figs.

The standard progression of alteration from pure ilmenite to a mixture of rutile and hematite (or any related titanium and iron oxide minerals) has been confirmed by chemical,

optical, and physical analyses. In the first stage the ilmenite has undergone little, if any, alteration. In the second stage, the ilmenite structure has broken down to amorphous material, with reduced mass susceptibility, giving a diffuse pattern of rutile (and possibly anatase or brookite). The term *hydroilmenite* is proposed for the second phase; 'arizonite' [M.A. 11–198, 245] is the final phase of alteration in which recrystallization giving a mixture of titanium and iron oxide minerals has occurred.

G. S. C.

KARKHANAVALA (M. D.) & MOMIN (A. C.). *The alteration of ilmenite.* Econ. Geol., 1959, **54**, 1095–1102, 2 figs.

The oxidation of ilmenite in air at 850°C yields a mixture of hematite, pseudobrookite, and rutile in an approximate molar ratio of 1:5:7. At 650°C a mixture of hematite, probably some rutile, and a phase as yet unidentified is obtained. The oxidation products are weakly paramagnetic, the susceptibility decreasing with increasing temperature of oxidation. Colour changes indicate that oxidation may commence at 100° and 200°C.

G. S. C.

YAMAOKA (KAZUO). *Garnet from the Toroku mine, Miyazaki Prefecture.* Kumamoto Journ. Sci., ser. B., sect. 1, 1959, **3**, no. 2, 37–40, 1 fig., 1 pl., 3 tables.

In the contact-metamorphic Sn-As ores of the Toroku mine, garnet formed at three stages. In the earliest the garnet is grossular with n 1.74₆, sp. gr. 3.58, a 11.84Å; in the second it is an andradite (Gr 32%) with n 1.84, sp. gr. 3.75, a 11.96Å; in the latest it is andradite with n 1.88, sp. gr. 3.80, a 12.01Å. The content of minor elements as spectrographically determined is reported for five samples of andradite and two each of danburite and axinite occurring with the ore.

A. P.

WEIBEL (M.). *Chemische Untersuchungen an alpinen Kluftmineralien.* Schweiz. Min. Petr. Mitt., 1961, **41**, 8–11, [summary of conference].

The chemical variability of adularia and carbonates from Alpine joints is studied. In 30 adularia crystals sodium, determined by flame photometry, increases gradually from north (Aar massive) to south (Penninic region) within the Central Alps, the range being from 3 to 17 mol% albite. One magnesian calcite, 2 dolomites, 8 ankerites, and 1 siderite are plotted in the diagram CaCO_3 – MgCO_3 – FeCO_3 . An iron-rich ankerite from Grimsel shows an excess of CaCO_3 molecule.

M. G.

Petrology, general

WILLIAMS (F. A.). *A system of quantitative fragmentary petrography for intensely decomposed igneous and metamorphic rocks.* Rept. 21st Intern. Geol. Congr., Norden, 1960, Part 2, 83–90.

A system of petrography devised in Nigeria for the mapping and investigation of intensely decomposed granites is based on a more detailed study of the quartz and resistant heavy accessory mineral content than is possible in thin section petrography of fresh rocks. Examples are given of the use of quantitative fragmentary petrography in geochemistry and ore prospecting. [M.A. 13-109]

R. A. H.

JEFFERY (P. G.). *The silica and alumina content of the standard rocks G-1 and W-1*. Geochim. Cosmochim. Acta, 1960, **19**, 127-133.

Recent determinations (post 1955) of SiO_2 and Al_2O_3 in granite G-1 and diabase W-1 do not agree with the preferred values calculated by H. W. Fairbairn, 1953 [M.A. 12-264]. The original data for G-1 and W-1 have been re-examined and revised values calculated for SiO_2 and Al_2O_3 . Some of the recent determinations of SiO_2 and Al_2O_3 in G-1 and W-1 closely agree with the new revised values.

R. C.

LYON (R. J. P.), TUDDENHAM (W. M.), & THOMPSON (C. S.). *Quantitative mineralogy in 30 minutes*. Econ. Geol., 1959, **54**, 1047-1055, 5 figs.

From standard calibration curves obtained by using individual pure minerals, and with the aid of synthetic mixtures of the diagnostic minerals, the quantities and types of minerals present in unknown samples can be determined rapidly using the infrared spectrophotometer. Almost all acid igneous rocks can be rapidly classified by this method.

G. S. C.

ECKERMAN (H. V.). *Borengite. A new ultra-potassic rock from Alnö Island*. Arkiv Min. Geol. Stockholm, 1960, **2**, 519-528, 12 figs.

A new ultra-potassic rock, *borengite*, is reported from Alnö Island, Sweden. Chem. analysis by Blix gave: SiO_2 56.96, Al_2O_3 20.24, Fe_2O_3 1.11, FeO 1.18, MgO 0.29, CaO 1.93, BaO 0.13, SrO 0.01, Na_2O 0.18, K_2O 14.08, $\text{H}_2\text{O}+$ 1.25, $\text{H}_2\text{O}-$ 0.36, TiO_2 0.26, P_2O_5 0.06, MnO 0.07, F 0.37, S 0.26, CO_2 1.47, = 100.21-0.30 O for F, = 99.91. Sp. gr. 2.752. Opt. data, Niggli values, and mode are given. The genesis of borengite is discussed. [M.A. 11-27] E. P.

[ГАРЬЕВА (G. M.)] Гареева (Г. М.). Уссурит — особая разновидность щелочных базальтоидных пород [*Ussurite — a special variety of alkaline basaltoid rocks*]. Доклады Акад. Наук СССР [C.R. Acad. Sci. U.S.S.R.], 1959, **126**, 157-159, 1 fig.

A newly discovered igneous rock named *ussurite* is found in the upper reaches of the river Ussuri, Maritime Province, Siberia, as well as in certain localities in Mongolia and Central Asia. According to its chemical composition this

rock may be called a trachydolerite. Analysis gave SiO_2 42.80, TiO_2 2.32, Al_2O_3 12.62, Fe_2O_3 7.57, FeO 5.05, MnO 0.14, MgO 11.61, CaO 9.56, Na_2O 3.31, K_2O 0.50, P_2O_5 0.80, H_2O 3.72%, [total not given]. Modal analysis gave: olivine 16, titanite 40, potash-oligoclase 36, analcime and montmorillonite 3, apatite 1. Under the microscope it is seen to be made of large grains of potash-oligoclase (α 1.528, γ 1.536) poikilitically enclosing grains of olivine and pyroxene. This rock passes gradually into a variety made of labradorite laths enclosing grains of potash-feldspar (n 1.529) which may be microcline or anorthoclase.

S. I. T.

[PETROV (P. S.)] Петров (П. С.). Ужурские нефелиновые руды [*Uzhur nepheline ores*]. Тр. Вост.-Сиб. Фил. Акад. Наук СССР [Trans. East-Siberian Fil. Acad. Sci. U.S.S.R.], 1958, **13**, 93-100.

Bereshite, after the River Beresh in the Krasnoyarsk region of Siberia, is a new name for an intrusive nepheline-rich rock, of which nepheline forms 20-55%. It contains nepheline phenocrysts and a few plagioclase and pyroxene phenocrysts. The groundmass is made up of plagioclase, nepheline, pyroxene, and altered glass. The content of SiO_2 and Al_2O_3 , in fresh and altered rock respectively, is 46.78, 46.32% and 23.71, 22.12%.

S. I. T.

SHIBATA (HIDEKATA), OKADA (SHIGERU), & HARA (KIKUO). *Chemical composition of Japanese granitic rocks in regard to petrographic provinces. Part I*. Sci. Repts., Tokyo Univ. of Education, sect. C, 1954, **3**, 141-172, 17 figs.

— — —. — *Part II. Principal elements*. Ibid., 1955, **4**, 141-161, 13 figs.

OKADA (SHIGERU). — *Part III. Trace elements*. Ibid., 1955, **4**, 163-184, 11 figs.

SHIBATA (HIDEKATA). — *Part IV. Petrographic provinces of eastern Japan*. Ibid., 1956, **5**, 1-23, 13 figs.

OKADA (SHIGERU). — *Part V. Chronological effect on the contents of trace elements*. Ibid., 1956, **5**, 25-38, 7 figs.

SHIBATA (HIDEKATA), OKADA (SHIGERU), & ŌKI (YASUE). — *Part VI. Principal elements*. Ibid., 1958, **6**, 31-54, 17 figs.

In Part I 112 new chemical analyses of granitic rocks from six of the petrographic provinces in central and northern Honshu are reported. Within each province several types (series) of granitic rocks are recognized. In the tabulations and the associated variation diagrams analyses are grouped by province and type. The types are distinguished by local Japanese names. In Part II 72 more new chemical analyses of granitic rocks, representing additional petrographic provinces are reported with

variation diagrams and brief notes on geology or related mineral deposits. Part III presents the spectrographically determined concentrations in p.p.m. of Ba, Sr, B, Ga, V, Pb, Sn, Cr, Ni, and Co for 86 specimens for most of which chemical analyses were reported in previous parts. Part IV: ten petrographic provinces of granitic rocks are distinguished in eastern Japan. Relations among these are discussed in terms of several standard petrographic parameters and variation diagrams presented for the rocks of each province, the oldest being Pre-Gotlandian and the youngest Miocene; 29 more chemical analyses of granitic rocks are reported. Thirty more trace element analyses are reported in Part V. On the basis of these and some of the data reported in Part III the distribution of trace elements in six types of granitic rocks distinguished in the Hida-mountainland province is considered in detail. It is shown, for instance, that in the rocks of this province vanadium content decreases with increasing SiO_2 . In Part VI 80 additional chemical analyses of granitic rocks representing petrographic provinces in southwestern Honshu, Shikoku, and Kyushu are reported and their relations shown in variation diagrams.

A. P.

BAILEY (E. B.). *Some aspects of igneous geology 1908-1958*. Trans. Geol. Soc. Glasgow, 1958, **23**, 29-52.

A general review, with special reference to Scotland, of advances made in igneous petrology during the 50 years ended.

G. P. B.

MUIR (I. D.) & TILLEY (C. E.). *Mugearites and their place in alkali igneous rock series*. Journ. Geol., 1961, **69**, 186-202, 7 figs., 1 pl.

Hawaiites are found to be characterized by strongly zoned feldspar, ranging from calcic andesine to 'lime anorthoclase'. In contrast, mugearites proper are characterized by the predominance of 'lime anorthoclase' over labradorite, which itself is more sodic than that of hawaiites. These results are based on petrographic study of such rocks from the Hebrides, Hawaii, and New Zealand and on 11 new rock analyses by J. H. Scoon. In addition these generally fine-grained rocks were separated into fractions, by differential chemical treatment and centrifuging in density liquids, which were analysed chemically by J. H. Scoon. The fractions are regarded as sufficiently pure to represent the individual minerals as follows: 10 pyroxene analyses, 10 opaque minerals, 7 plagioclase, 14 anorthoclase, and 4 soda clinopyroxene. Some anorthoclase was found to contain as much as 24% CaO.

R. E. W.

Petrography, regional

MATTHEWS (D. H.). *Lavas from an abyssal hill on the floor of the North Atlantic Ocean*. Nature, 1961, **190**, 158-159, 3 figs.

Of 362 dredged stones, 354 are of highly altered vesicular basalt (porphyritic bytownite-rich augite-basalt without olivine). Some are pillow-shaped and contain fresh tachylitic marginal material which has escaped palagonitization. Cracks in the lava contain palagonite, chlorophaeite, calcite, and zeolites.

M. J. LE B.

UPTON (B. G. J.). *The alkaline igneous complex of Kûngnât Fjeld, south Greenland*. Medd. om Grønland, 1960, **123**, no. 4, 1-145, 57 figs., 6 pls.

The Kûngnât complex consists of three intrusions of saturated syenite and a gabbro ring-dyke. The second syenite intrusion possesses the characteristics of a layered intrusion of Skaergaard type with rhythmic banding, cryptic layering, and feldspar lamination. The differentiated sequence in the lower part of the layered series is analogous to the larvikite-nordmarkite-ekerite sequence of the Oslo region. Partial analyses of the feldspars from the syenites show a molecular composition range $\text{Ab}_{59}\text{Or}_{29}\text{An}_{10.5}\text{Cn}_{1.5}$ to $\text{Ab}_{59}\text{Or}_{37.5}\text{An}_{3.5}$. Optics indicate a pyroxene range from augites (ca. $\text{Ca}_{42}\text{Mg}_{20}\text{Fe}_{38}$) through ferroaugites to hedenbergitic types and, with progressive Na enrichment, to aegirine-augites. Olivines in the syenites range from ca. $\text{Fa}_{80}\text{-Fa}_{100}$. Four chemical analyses of rocks are given, together with twenty-four approximate analyses. Trace element data (determined by emission spectroscopy) are also presented. [Author's abstract.]

J. Ph.

WALKER (GEORGE P. L.). *Zeolite zones and dike distribution in relation to the structure of the basalts of eastern Iceland*. Journ. Geol., 1960, **68**, 515-528, 5 figs.

In the Tertiary olivine basalts, mesolite and scolecite are the predominant vesicle fillings in a lower zone more than 2500 feet thick. Analcime predominates in the next 500-foot zone, and chabazite and thomsonite in an upper zone. Vesicles are empty in the overlying Quaternary basalts. In the Tertiary tholeiitic basalts a lower zone more than 1000 feet thick has vesicles filled with stilbite, heulandite, scolecite, and epistilbite accompanied by quartz and chalcedony. The vesicles of about the next 1500 feet are filled with mordenite, quartz, chalcedony, chlorophaeite, and celadonite. Above this the vesicles are empty. This zonation, as well as the decrease of dikes with elevation, help to place the elevation of the top of the volcanic pile, now in part removed by erosion, and to show that most of the individual flows must have thinned up-dip, towards the source areas. The lighter colour of the basalts in the upper parts of the pile (the so-called 'Gray Stage' lavas) is attributed to the lack of filling of the vesicles and spaces between feldspars and to lack of alteration of their olivine.

R. E. W.

MERILÄINEN (KAUKO). *Albite diabases and albitites in Enontekiö and Kittilä, Finland.* Bull. Comm. Géol. Finlande, 1961, **195**, 1-75, 19 figs.

Five varieties of albite diabases are found: amphibole-pyroxene-albite diabases, amphibole-epidote-albite diabases, amphibole-albite diabases, biotite-albite diabases, chlorite-albite diabases. They occur as simple or differentiated sills, derived from parent olivine basaltic magma. The main rock-forming minerals have been analyzed chemically and studied optically. Petrographical descriptions are given, and the genesis of the albite diabases and albitites is discussed.

M. H.

MARMO (VLADI). *Serpentinite of Pahta-austi, Finnish Lapland.* C.R. Soc. Géol. Finlande, **32**; Bull. Comm. Géol. Finlande, 1960, **188**, 67-76, 7 figs.

The serpentinite studied consists mainly of antigorite and chrysotile with a few needles of tremolite and scarce minute grains of olivine. Narrow shear zones filled by chlorite and chrysotile cut the rock. Veinlets of magnetite consist in part of magnetite of fibrous shape the lattice being, however, normal. The fibrous magnetite occurs intermixed with fibrous serpentine which, despite its appearance, is antigorite ($d_{24.3.0} = 1.563\text{\AA}$; $d_{060} = 1.541\text{\AA}$). The antigorite contains Al 1.22, Cu 0.007, Ni 0.2, Co 0.02, Ag 0.0002, Cr 0.4-0.5, Mn 0.05%. Analysis of serpentinite gave SiO_2 34.39, TiO_2 0.01, Al_2O_3 0.10, Fe_2O_3 5.46, FeO 2.88, MnO 0.08, MgO 41.38, CaO 0.07, Na_2O 0.21, K_2O 0.00, P_2O_5 0.02, CO_2 0.55, $\text{H}_2\text{O} +$ 13.55, $\text{H}_2\text{O} -$ 0.55, Cr_2O_3 1.03, NiO 0.35, S 0.01, =100.64.

M. H.

QUENSEL (P.). *Några iakttagelser beträffande förekomsten av hastingsitgranit inom ett område söder om Ätvidaberg* [Some observations on the occurrence of hastingsite granite within an area south of Ätvidaberg]. Geol. Fören. Förh. Stockholm, 1958, **80**, 315-332, 7 figs.

In the neighbourhood of Ätvidaberg, Östergötland county, a gneissic granite with high potassium content has its composition changed locally by metasomatic processes. Biotite is partly replaced by hastingsite, and a new-formed orthoclase perthite occurs along with microcline perthite. The change in composition of the granite (decrease in SiO_2 and increase of FeO and CaO) is demonstrated by chemical analyses. In close connection with the gneissic granite there occurs a pyroxene syenite containing hastingsite. Here also biotite is replaced by hastingsite but this is partly replaced by a pyroxene with 13 mol% aegirine. The optical data for the hastingsite are $2V$ $49.0^\circ \pm 1^\circ$, $\gamma:c$ $+19.9^\circ$, $\gamma-\alpha$ 0.020 ± 0.003 , α pale green, β green-blue with tinge of brown, γ green-brown to brown; for the pyroxene $2V$ $65.0^\circ \pm 1^\circ$, $\alpha:c$ -34.1° , $\gamma-\alpha$ 0.031 , α pale blue, β pale green, γ blue green. The author supposes that the

pyroxene syenite (chemical analysis given) has been developed by the same metasomatism, but with a further supply of magnesia and a decrease in the alkali content.

E. W.

GUSTAVSON (MAGNE) & GRØNHAUG (ARNE). *En geologisk undersøkelse på den nordvestlige del av kartblad Berge-fjell.* Norges Geol. Unders., 1960, **211**, 26-74, 1 pl., 6 figs. English summary: A geological investigation of the Caledonid[es] of the Majavatn-Kvigtind region, Nordland, Norway.

The paper reports on a general geological investigation of the area, but the greater part of it consists of mineralogical, chemical, and structural descriptions of the rocks and discussions of the conditions of formation. The rocks comprise micaceous gneisses and various micaschists, granodioritic gneisses, calcite marbles with local reaction skarns, quartzites, amphibolites, trondhjemite and granodiorite, dunites and dunite conglomerate, pegmatites.

I. W. O.

HJELLE (AUDUN). *Grunnfjellet omkring Tangen, østsiden av Mjøsa.* Norges Geol. Unders., 1960, **211**, 75-97, 11 figs., (English abstract).

A description of the rocks and structures in an Archaean gneiss area in SE Norway. The rocks are granite and granitic gneisses, granodiorite, mixed gneiss, diorite and quartz diorite, gabbro, diabase dikes, and carbonate veins. Chemical changes in granite adjacent to a dioritic xenolith have been established by modal analysis.

I. W. O.

RAY (P. S.). *Ignimbrite in the Kilchrist vent, Skye.* Geol. Mag., 1960, **97**, 229-238, 2 figs., 1 pl.

Ignimbrite steeply intrusive into the basaltic agglomerate of the Kilchrist vent is described. The ignimbrite shows flow structure parallel to the walls, flow being expressed by the elongation and alignment of the constituent shreds of devitrified glass and pumice lapilli. Fragments of basalt, derived from the vent agglomerate, are sometimes also drawn out in the direction of flow.

B. W. E.

STEWART (F. H.) & JOHNSON (M. R. W.). *The structural problem of the Younger Gabbros of North-East Scotland.* Trans. Edin. Geol. Soc., 1960, **18**, 104-112.

The authors suggest that some of the 'older' gabbros are in reality parts of the 'younger' gabbro mass of Huntly but have been deformed by the folding of the district shortly after their intrusion.

G. P. B.

FRANCIS (E. H.). *Intrusive tuffs related to the Firth of Forth volcanoes.* Trans. Edin. Geol. Soc., 1960, **18**, 32-50.

Descriptions are given of tuffs intruded into Carboniferous sediments adjoining necks in the Fife coalfield. The

tuff intrusions, encountered in boreholes, consist of comminuted sediments with or without an admixture of basaltic lapilli. They are compared with similar bodies known from nearby surface exposures and previously thought to be of non-volcanic origin. The role of tuff intrusion in the formation of the necks is evaluated.

G. P. B.

TOMKELEFF (S. I.) & LONGSTAFF (M.). *The magmatic complex at Kingscross Point, Isle of Arran*. Trans. Edin. Geol. Soc., 1961, **18**, 194–201.

The relationships of olivine-dolerite and crinanite at Kingscross Point are accounted for by a complex series of events including successive intrusion, fragmentation, rheomorphism, and mobilization of the rheomorphic material.

G. P. B.

ELLIOTT (R. B.). *The Carboniferous volcanic rocks of the Langholm district*. Proc. Geol. Assoc., 1960, **71**, 1–24.

An account of the occurrence and petrography of olivine-basalts and trachybasalts of Lower Carboniferous age, with four new analyses quoted to one decimal place.

R. St J. L.

HUGHES (CHARLES JAMES). *The Southern Mountains igneous complex, Isle of Rhum*. Quart. Journ. Geol. Soc. London, 1960, **116**, 111–138, 1 fig., 4 pls., 1 map, 5 tables.

The Tertiary acid igneous complex at the southern edge of the layered ultrabasic intrusion [M.A. 14–69] has been mapped in detail, the rocks of primary concern being felsites, explosion breccias, intrusive tuffs, and granophyre. A new chemical analysis of a granophyre resembles closely that of a felsite from this region; similarities also in feldspar phenocryst and modal compositions lead to the conclusion that the two rocks crystallized from almost identical magmas. The order of intrusion (felsites and associated explosion breccias—'intrusive tuffs'—granophyre) is believed to reflect increasing depths of formation. The escape of water vapour from the porphyritic acid magma, which subsequently crystallized as felsite, produced explosion breccias and 'intrusive tuffs', while the same magma at a greater depth retained the water and crystallized as granophyre. Similar rock associations are characteristic of parts of the neighbouring Tertiary volcanic centres of Skye,¹ Mull, Arran, and Slieve Gullion.

G. M. B.

WILSON (H. E.). *An intrusive igneous boss at Dunanney, Carnmoney*. Irish Natur. Journ., 1960, **13**, 163–166, 2 figs.

A small olivine dolerite mass intrudes Trias (Keuper marl) 900 yards SE of Carnmoney church, near Belfast. A marl screen between it and a probably contemporaneous dyke has developed minute feldspar grains.

J. P.

STANTON (W. I.). *The Lower Palaeozoic rocks of south-west Murrisk, Ireland*. Quart. Journ. Geol. Soc. London, 1960, **116**, 269–296, 8 figs., 1 pl., 1 map.

A series of strata of Ordovician and Silurian age include rocks, formerly identified as lavas or intrusions, which are shown to be interbedded tuffs. The tuffs in the Sheefry Grits (Arenigian) show graded bedding and were probably deposited in marine conditions, while those in the Mweelrea Grits (Middle Ordovician) are welded and were probably deposited in shallow water. The sediments are intruded by the Corvock granite, of Caledonian age, and several sets of minor intrusions.

B. C. M. B.

McKerrow (W. S.) & Campbell (C. J.). *The stratigraphy and structure of the Lower Palaeozoic rocks of north-west Galway*. Sci. Proc. Roy. Dublin Soc., 1960, ser. A, **1**, 27–52, 7 figs., 6 pls.

Ordovician vulcanicity is represented by Arenig spilites and basic tuffs, with ignimbrites and agglomerates in the Caradoc-Llandeilo. A felsite with shattered phenocrysts possibly is the vent for the extensive beds of welded tuff—characterized by glass shards, lapilli, and broken crystals similar to those of the felsite; the base of one bed shows evidence of chilling against sea water. A volcanic outbreak in Upper Llandovery produced albite-trachyte lavas with pillow structures; similar dykes cut Arenig rocks. Caledonian dykes and sills, all altered, include early lamprophyres, originally of orthoclase, hornblende, augite, and mica; intrusion of highly fluid magma into partially consolidated sediments is indicated. Thick microgranodiorite sills (one with a more basic top), andesites, and felsites complete the time sequence. NE-trending fresh teschenite dykes are considered to be of Tertiary age.

J. P.

CHARLESWORTH (H. A. K.). *The Lower Palaeozoic inlier of the Curlew Mountains anticline*. Proc. Roy. Irish Acad., 1960, **61B**, 37–50, 3 figs.

The Ordovician succession is almost wholly volcanic; 4500 feet of pyroclastics and columnar jointed felsite flows (the tuffaceous group of Arenig age), are followed by some 2500 feet of porphyritic felsites, dacites, and spilites (the felsitic group of possibly post-Arenig age). A feeder vent for these felsites is suggested and an intrusive granophyre briefly described.

J. P.

DAVIES (R. G.). *The Cader Idris granophyre and its associated rocks*. Quart. Journ. Geol. Soc., London, 1959, **115**, 189–216, 6 figs.

Results of a detailed field, petrographic, and chemical investigation of the Cader Idris granophyre and its surrounding Ordovician lavas, pyroclastic deposits, sediments, and doleritic intrusions are given. Sixty rocks analysed

by rapid methods include acid, intermediate, and basic lavas, acid tuffs, dolerites, granophyres, and metasomatized contact rocks. The results suggest that the granophyre was emplaced as magma but caused some mobilization and metasomatism of country rocks near the contacts, as well as of xenoliths and rafts enclosed in a discordant, vent-like portion of the intrusion. An associated quartz-diorite sill and certain lavas of intermediate composition in the Ordovician succession are believed to have originated at depth by such processes of thermal mobilization and metasomatism. The granophyre lifted its roof more than 1500 feet, and being physically connected with the rhyolites uppermost in the volcanic sequence, its age is fixed.

B. W. E.

SHACKLETON (R. M.). *The stratigraphy of the Moel Hebog district between Snowdon and Tremadoc*. Liverpool and Manchester Geol. Journ., 1959, **2**, 216-252.

A description of the Upper Ordovician Snowdon volcanics is given, with new analyses of a basalt, a spilitic bomb, and intrusive rhyolites. Evidence is given for believing that some of the intrusive rocks are of Caledonian age.

R. St J. L.

TILLEY (C. E.). *A note on the nosean phonolite of the Wolf Rock, Cornwall*. Geol. Mag., 1959, **96**, 503-504.

A new analysis by J. H. Scoon shows that the phonolite contains more potash than earlier analysts had found. The sanidine phenocrysts (full analysis) have a composition of $\text{Or}_{59.4}\text{Ab}_{39.4}\text{An}_{0.6}\text{Cn}_{0.6}$. A partial analysis of the nepheline is given, together with some data on a rare mineral, provisionally compared with the johnstrupite-mosandrite group. Trace element data are also given for the phonolite.

R. St J. L.

MIDDLETON (G. V.). *Spilitic rocks in south-east Devonshire*. Geol. Mag., 1960, **97**, 192-207, 2 figs.

A stratigraphical and petrographical account of igneous activity in south-east Devonshire, comprising Middle and Upper Devonian spilitic and keratophyric lavas and tuffs and Upper Carboniferous spilitic dolerite sills.

B. W. E.

METAIS (DANIELLE). *Etude pétrographique des kersantites et de quelques autres roches filoniennes de la rade de Brest (Finistère)*. Thèse. Pétrographie. Paris, 1959, 1 vol. (4° ronéo), 126 pp., 6 microphotos, 7 figs., 1 map 1 : 50,000.

— *Caractères pétrographiques et chimiques des kersantites de la rade de Brest*. C.R. Acad. Sci., Paris, 1960, **251**, 2202-2203.

These plagioclase-mica lamprophyres include a dark type and a pale type corresponding to quartz-gabbro and quartz-

diorite, respectively giving on analysis SiO_2 50.10, 54.70, Al_2O_3 14.50, 14.65, Fe_2O_3 1.10, 0.80, FeO 6.00, 5.05, MgO 8.45, 7.30, CaO 6.20, 5.05, Na_2O 2.15, 3.75, K_2O 3.10, 3.95, $\text{H}_2\text{O}+$ 3.50, 3.21, $\text{H}_2\text{O}-$ 0.40, 0.30, TiO_2 1.05, 1.05, P_2O_5 0.56, 0.59, MnO 0.13, 0.15, CO_2 2.90, 0.34, = 100.14, 100.89.

E. J. & A. S.

VIALON (PIERRE). *Etude géologique de la partie centrale du massif granitique de Guéret (Creuse, Massif central français)*. Bull. Soc. géol. France, 1959, **1**, 857-861, 3 figs. incl. 1 map.

The old migmatic material—'Aubusson gneiss'—is a nebulite-anatexite, rarely corrugated, composed of quartz, microcline-anorthoclase, oligoclase, biotite, and altered cordierite; the two latter form dark lumps which simulate pebbles in conglomerate. In places the gneiss is in contact, occasionally with transitional passage, with the Guéret granite. This biotite-cordierite-granite has many inclusions including very micaceous schists, microgranites, garnet-sillimanite-migmatite, and serpentine. Its various characters, along with absolute age (Pb-zircon) determinations, give evidence of mobilization of the migmatite basement; the Guéret granite is thus locally late even in the 'Aubusson gneiss'. [M.A. 15-54]

E. J. & A. S.

RUTTEN (MARTIN G.). *Ignimbrites permienes de l'Esterel*. C.R. somm. Soc. géol. France, 1959, **6**, 168-169.

The Esterel ignimbrites would be produced by the extrusion mechanism of 'fluidization' [D. Reynolds, M.A. 13-537]. The rhyolites of the Esterel would form ignimbritic flows of fluidized tuff, whilst the magmatic rocks would remain true acid lavas with fluidal structure. [M.A. 14-511]

E. J. & A. S.

LAPADU-HARGUES (PIERRE). *Note sur la 'fraïdonite' de la Lozère*. Bull. Carte géol. France, 1959 (1961), **57**, 395-409.

'Fraïdonite' is a kersantite found as dikes in the schists and granites of the southern Cevennes; it is composed essentially of biotite, chlorite, plagioclase, and a little quartz, magnetite, pyrite, and calcite. The dikes arise by differentiation of the granitic magma with expulsion of Fe and Mg. Four new analyses are given: (A) near Bouzèdes (Gard), (B) Val du Tarnon (Lozère), (C) Chateau de Bussac (Gard), (D) between Thier and Noirétable:

	SiO_2	Al_2O_3	Fe_2O_3	FeO	MgO	CaO	Na_2O	K_2O	$\text{H}_2\text{O}+$	$\text{H}_2\text{O}-$	Total
A	54.00	16.95	2.05	4.70	5.80	2.25	2.35	4.25	5.90	0.30	99.50
B	59.85	16.75	1.10	4.65	3.65	2.10	2.65	4.00	2.75*	0.20	98.95
C	57.95	14.65	1.60	3.60	6.90	3.10	2.85	6.50	2.00	0.05	100.33
D	52.90	16.30	1.90	5.30	7.45	4.85	2.85	1.90	2.35†	0.10	98.03

* + SO_2 = 0.40;

† + CO_2 = 1.95.

Totals include: A, TiO_2 0.60, P_2O_5 0.15, MnO 0.20; B, TiO_2 0.50, P_2O_5 0.30, MnO 0.05; C, TiO_2 0.80, P_2O_5 0.30, MnO 0.05; D, TiO_2 0.85, P_2O_5 0.35, MnO 0.05

E. J. & A. S.

ROBERT (PIERRE). *Sur certaines minéralisations de la région de St-Paul-de-Fenouillet (Pyrénées Orientales)*. C.R. somm. Soc. géol. France, 1959, **6**, 97-98.

The crystalline massif of Agly in this region is formed by biotite-granite which passes laterally to migmatite. It contains pegmatitic lenses composed of quartz and albite with rare muscovite and tourmaline. Graphite is found in the garnetiferous margins of these lenses. Veins of hematite, occasionally in exploitable amount, cut gneiss, granite, and pegmatite. The presence of uranium is evident in the uranionitized zones.

E. J. & A. S.

REIVA (J. M. COTELO). *Petrografia de alguns granitos do distrito de Bragança*. Mem. & Not., Publ. Mus. Lab. Min. Geol., Univ. Coimbra, 1958, **45**, 40-55, 2 figs., 4 pls., (summaries in English and French).

Petrographical descriptions with chemical analyses are presented of eight rocks ranging from muscovite granite (74.02% SiO₂) to biotite granodiorite (64.57% SiO₂). I.P.W. norms and Niggli values are listed, and Q-F-M and k-mg relations shown on diagrams.

J. Ph.

RIES (E. G.). *Chemical analysis of two pantellerites*. Journ. Petr., 1960, **1**, 304-8.

Re-analysis of two hyalo-pantellerites from Pantelleria which had previously been analysed by H. S. Washington gave, respectively, SiO₂ 69.81, 69.56, Al₂O₃ 8.59, 11.27, Fe₂O₃ 2.28, 1.87, FeO 5.76, 4.18, MgO 0.10, 0.23, CaO 0.42, 0.44, Na₂O 6.46, 6.28, K₂O 4.49, 4.60, H₂O+ 0.14, 0.13, H₂O- 0.05, 0.02, TiO₂ 0.45, 0.47, ZrO₂ 0.25, 0.12, P₂O₅ 0.13, 0.10, SO₃ 0.06, 0.06, Cl (H₂O sol.) 0.03, 0.01, Cl (H₂O insol.) 0.76, 0.37, MnO 0.28, 0.28, less O for Cl 0.18, 0.09, =99.88, 99.90. Difference from old analyses lay mainly in the determination of Cl, not determined by Washington, and in the SiO₂ and Al₂O₃ values for one of the rocks, but there was no change in Washington's finding of a molar excess of alkalis over available R₂O₃.

M. G. B.

RAYAN (SIROUS). *Découverte d'un gisement de norite près de Château-Lambert (Vosges méridionales)*. C.R. somm. Soc. géol. France, 1959, **6**, 78-79.

This mica-2pyroxene norite occurs as an enormous enclave—of kilometric dimensions—in the Ballon d'Alsace granite and has resisted assimilation. It is bordered by a mica-diorite with uraltized monoclinic pyroxene and prehnitized plagioclase. Modal compositions are: norite—30-60% plagioclase, 20-35 biotite, 46-97 pyroxenes, 2-06 accessories; norite—41-96% plagioclase, 10-97 biotite, 45-95 amphibole, 10 accessories.

E. J. & A. S.

LSAC (CLAUDE). *Nature pétrographique et origine des albitophyres du dôme de Remolon (Hautes Alpes)*. C.R. Acad. Sci., Paris, 1960, **250**, 1681-1682.

Albitophyres (spilites, keratophyres, and orthoalbitophyres) form flows at the very top of the Trias; they were poured out at the surface or on the bottom of lagoons in which dolomite was being deposited. Chem. analyses are: A, spilite from Antonious near d'Espinasses; B, spilite from Theus; C, keratophyre, near Theus.

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO	MnO	MgO	CaO	Na ₂ O	K ₂ O
1.	53.10	15.80	1.70	8.50	0.10	5.50	2.60	5.85	0.50
2.	45.4	16.4	8.8	6.75	tr.	5.6	3.2	4.45	1.65
3.	54.56	18.40	3.86	4.62	0.02	2.63	1.79	8.02	tr.

	TiO ₂	P ₂ O ₅	H ₂ O+	H ₂ O-	CO ₂	S	Total
1.	1.20	0.60	4.40	0.10	1.25	—	100.70
2.	2.00	0.80	3.0	0.2	2.6	tr.	100.85
3.	2.22	0.39	2.40	0.19	—	0.30	99.40

The spilites are composed of albite, chloritized olivine, mica, talc, quartz, calcite, opaque minerals, and leucoxene. The keratophyres are richer in albite, poor in feldspars. Orthoalbitophyres are scarcer; they contain orthoclase.

E. J. & A. S.

MICHEL (ROBERT) & TANE (JEAN-LOUIS). *Découverte de laves en coussins (pillow-lavas) dans de Trias de la zone dauphinoise (massif du Pelvoux)*. C.R. Acad. Sci., Paris, 1960, **250**, 2735-2737.

E. J. & A. S.

MICHEL (ROBERT), MORET (LÉON), & TANE (JEAN-LOUIS). *Sur la présence des spilites potassiques dans la couverture triasique du massif du Pelvoux (Alpes dauphinoises)*. C.R. Acad. Sci., Paris, 1960, **251**, 184-187.

Six chemical analyses are given.

E. J. & A. S.

ELLER (JEAN-PAUL VON). *Sur l'extension des 'durbachites' et autres roches basifiées au sein des gneiss de Sainte-Marie-aux-Mines dans les Vosges (Haut-Rhin)*. Bull. Soc. géol. France, 1960, 15-18.

Durbachite, a mesocratic syenitic gneiss, with biotite and large crystals of microcline and occasionally pyroxene also appears amidst the gneisses bordering granite. It has originated by basification and feldspathization of leptynites; temperature of formation, calculated by Barth's method, is 520°C ± 50°. Microsyenites which further north stretch into the Urbeis gneiss represent the durbachites of Sainte-Marie-aux-Mines but they were emplaced by intrusion. The durbachites and the micro-syenites are intimately related to the granite which they surround.

[M.A. 14-223, 367]

E. J. & A. S.

SAUCIER (HENRI), MILLOT (GEORGES), & JOST (ROLAND). *Les ignimbrites permienues de la région du Nideck (Vosges-Alsace)*. Bull. Carte géol. Alsace-Lorraine, 1959, **12**, 33-48, 2 figs., 1 pl.

The Permian volcanics of Nideck lie discordantly on the Devonian-Dinantian basement of the Vosges; they are 60 to 150 metres thick and include three members. The middle

(principal and thickest) is composed of ignimbrites; the lower consists of tuff deposited at relatively low temperature; upwards towards the top the ignimbrites contain flattened enclaves of spherulitic rhyolite or recrystallized glass, the matrix having the vitroclastic structure characteristic of ignimbrites. The highest flow, which is the thinnest (about 50 metres) and least extensive, is likewise represented by ignimbrite but it is recrystallized. Content of alkalis, by flame spectrophotometry, is about 1.2% Na₂O, 4.5% K₂O. Palaeomagnetic measurements of the remanent magnetization show that the rock has been emplaced at a temp. higher than the Curie point of magnetite.

E. J. & A. S.

ELLER (JEAN-PAUL VON). *Contribution à l'étude des faciès marginaux du granite de Natzwiller et du granite de Kagenfels (Champ-du-Feux). Cortèges filoniens.* Bull. Serv. Carte géol. Alsace-Lorraine, 1959, **12**, 85–96.

The two granites result from the evolution of a granitic magma during Hercynian time.

E. J. & A. S.

KARL (F.) & MORTEANI (G.). *Ein Vergleich der Ergebnisse von A. Bianchi und F. Karl über die granitischen Gesteine des Zillertales und des Grossvenedigers (Hohe Tauern).* Tschermarks Min. Petr. Mitt., 1960, ser. 3, **7**, 290–316, 4 figs., (Italian summary, pp. 313–315).

A new chemical analysis, by H. Werner, of tonalite from the Obersulzbach Valley, Austria, is reported. In attempting the reconciliation of earlier interpretations by A. Bianchi (1934) and F. Karl (1959), all available analyses of granitic rocks from the region of the Zillertal and the Grossvenediger are tabulated.

A. P.

BECK-MANNAGETTA (P.). *Die Stellung der Gurktaler Alpen im Kärntner Kristallin.* Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **13**, 418–430, 1 fig.

The Gurktaler series (Palaeozoic?) consists of metabasites and calcareous and graphitic schists within phyllites. The iron ore mineralization of the western part is related to the overthrust over the central alpine Mesozoic.

R. A. H.

BAUTSCH (H.-J.). *Erzmikroskopische Beobachtungen an den Opakanteilen eines Metaserpentinits von Wurzbach (Thüringen).* Neues Jahrb. Min., Abhandl., 1960, **94**, 908–925, 4 pls.

Examination of the opaque minerals in a meta-serpentine from Wurzbach, Thüringia, revealed the presence of ilmenite with exsolved needles of rutile or with an unexplained lamellar intergrowth. Magnetite exsolution phenomena are considered to indicate that crystallization took place at above 800°C. Intergrowths of secondary magnetite

and actinolite, in association with a sulphide assemblage of pyrite, bravoite, chalcopyrite, and blende, indicate that the intrusion of a neighbouring granite and the actinolitization took place simultaneously.

R. A. H.

ROLLET (MICHEL). *Remarques sur un gisement ophiolitique dans la vallée du Lepenac (Macedoine Yougoslave).* C.R. Acad. Sc., Paris, 1960, **250**, 4184–4185.

E. J. & A. S.

KOZŁOWSKI (S.). *Wulkanizm Permski w rejonie Gluszyca i Świerków na Dolnym Śląsku* [Permian vulcanism in the Intrasedetic basin (Lower Silesia)]. Roczn. Pol. Tow. Geol., 1958, **28**, 1–52.

The author describes the volcanic rocks which are exposed near Gluszyca and Swierki and discusses the three volcanic cycles in the Intrasedetic basin. Structural forms of the volcanic and subvolcanic rocks are described. 19 new chemical analyses of melaphyres from the first and second cycles of volcanic activity are given. The relation of the Sudetic volcanic activity to the vulcanism of other regions is discussed, with special reference to the Cracow area.

W. S.

DZIEDZIC (H.). *Metasomatoza 'melafirów' permskich ze Świerków na Dolnym Śląsku* [Metasomatism of the Permian 'melaphyres' from Swierki (Lower Silesia)]. Roczn. Pol. Tow. Geol., 1958, **28**, 79–102.

The basic intrusive rocks exposed near Walbrzych (Lower Silesia), previously described by German authors as melaphyres, are considerably altered. L. Milch and G. Alaschewski assumed that the alteration was due to weathering. The present studies indicate that the rocks are spilitic and overlie unaltered quartz-dolerites. The genesis of the spilites is explained by the process of endogenous metasomatism caused by volatile components accumulating in the upper part of the lava flows. Nine chemical analyses are given.

W. S.

WIERZCHOŁOWSKI (B.). *Skaly ultrafemiczne okolic Bielic w Sudetach Wschodnich* [The ultramafic rocks of Bielice in Eastern Sudeten]. Arch. Mineral., 1960, **22**, 401–438, 2 figs., 3 pls., 4 tables.

The petrography and origin of the ultrabasic rocks and tonalites of the Bielice region and of similar rocks from the adjacent Czechoslovakian territories are discussed.

W. S.

DUMICZ (M.). *Obserwacje drobnych struktur tectonicznych w południowej części metamorfiku Gór Bystrzyckich* [Notes on minor tectonic structures in the southern part of the Bystrzyckie Mts. (Sudeten)]. Acta Geol. Pol., 1960, **10**, 49–64, (English summary).

The Precambrian metamorphic rocks in the Bystrzyckie Mts., composed of mica-schists and Bystrzyca gneisses, were subjected to strong deformation. Observations on the relationship of these two metamorphic complexes as well as on minor tectonic structures (foliation, lineation, drag folds, and small flexures) have helped to establish a number of phases in the metamorphism and tectonic deformation in the Bystrzyckie mountains.

W. S.

ЗНАВИН (А. Г.) [Жабин (А. Г.)]. О новом типе карбонатитовых проявлений в связи со щелочным комплексом Вишневых-Ильменских гор на Урале [On a new type of carbonatite occurrence associated with the alkaline complex of Vishnevyy-Ilmen mountains in the Urals]. Доклады Акад. Наук СССР [C.R. Acad. Sci. U.S.S.R.], 1959, **123**, 1020-1022.

In this igneous complex intrusion of miaskite was followed by albitization and carbonatization. Zones and phases of carbonatization are described and a list of the minerals present is given. It is suggested that carbonatite formations should be assigned to two distinct types: (1) platform type, in which carbonatites are associated with an ultrabasic alkaline magma, as a rule the intrusive mass being of oval-shape and zoned, with large localized masses of carbonatites; (2) geosynclinal type, in which carbonatites are associated with the nepheline syenite magma, as in the case of the Uralian occurrence described here.

S. I. T.

СЕРДЮЧЕНКО (Д. П.) [Сердюченко (Д. П.)]. Граниты Южного Тимана и их акцессорные минералы [The granites of Southern Timan and their accessory minerals]. Изд. Акад. Наук СССР [Publ. Acad. Sci. U.S.S.R.], 1959, 103 pp., 37 figs. Price 5r. 95k.

This is a petrological description of certain intrusive granites of Caledonian age and of the surrounding Proterozoic schists. The principal minerals of the granite are described in detail as are the accessory minerals enclosed as minute grains in the feldspars and micas, including zircon, orangite, monazite, xenotime, apatite, titanite, orthite, epidote, and dumortierite. Two chapters are devoted to properties of natural and heated (to 700°C) muscovite and biotite; another chapter to discussion of pleochroic haloes round the accessory minerals.

S. I. T.

ОСТРОУМОВА (А. С.) [Остроумова (А. С.)]. О новой находке лейцитовых пород в Закавказье [On a new find of leucite rocks in Transcaucasia]. Доклады Акад. Наук СССР [C.R. Acad. Sci. U.S.S.R.], 1959, **127**, 873-876, 1 fig.

Dykes, sheets, and plugs of leucite-tephrite were found intrusive into sandstone of Miocene or Oligocene age in Western Daralagez, south of Lake Gokcha in Armenia.

Modal analysis of this rock gave olivine 17, pyroxene 10, plagioclase 9, ores 2, groundmass glass 38-58, groundmass leucite 20-40%.

S. I. T.

BURRI (C.), GANSSE (A.), & WEIBEL (M.). Zur Petrographie des Vulkans Demavend (Iran). Schweiz. Min. Petr., Mitt., 1961, **41**, 6. [Summary of conference]

The results of 11 rock analyses of Demavend lavas are discussed. Only Niggli values are given. The lavas belong to two groups of trachyandesites, one of which contains olivine.

M. G.

BEYDOUN (Z. R.). Synopsis of the geology of East Aden Protectorate. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **21**, 131-149, 6 figs.

The Precambrian or Cambrian basement complex includes lavas, pyroclastic rocks, and marine sediments, with basic and granitic intrusions, subjected to low grade metamorphism.

R. A. H.

PRASAD (A. K.). Petrography of the Deccan trap flows of Linga, Chhindwara district, M.P. Quart. Journ. Geol. Min. & Met. Soc. India, 1959, **31**, 7-16, 11 figs.

Details of petrographic and mineralogical study of five Deccan basalt flows, averaging about 60 feet in thickness, are given. Each flow is doleritic in the middle and basaltic at the top and base.

A. P. S.

BANDYOPADHYAY (SAMIR KUMAR). Some basic inclusions in a group of schists, north of Raniganj coal-field. Quart. Journ. Geol. Min. & Met. Soc. India, 1959, **31**, 57-58, 2 figs.

Inclusions of unaltered dolerite and epidiorite in tremolite-chlorite schists are described.

A. P. S.

MISRA (R. C.) & SAXENA (R. L.). An occurrence of 'Keratophyre' like rock in Jhansi district, Uttar Pradesh. Quart. Journ. Geol. Min. & Met. Soc. India, 1959, **31**, 115-119, 6 figs.

A felsitic dyke rock in granite is described and on petrographic and chemical characters identified as a keratophyre [the norm calculation of the analysis is incorrect].

A. P. S.

ROY CHOUDHARY (SANATAN). Petrology of traps in north-east Rajmahal Hills, Santhal Parganas. Quart. Journ. Geol. Min. Met. Soc. India, 1959, **31**, 133-146, 12 figs.

Six different lava flows are described with mineralogical, petrographical, and chemical studies.

A. P. S.

DAVE (S. S.). A note on the petrology of the trappean flows around Ganeshgunj, Madhya Pradesh. Quart. Journ. Geol. Min. Met. Soc. India, 1960, **32**, 18-26, 8 figs.

The petrography, mineralogy, and micrometric analyses of four Deccan lava flows are reported. Palagonite, calcite, and chert are regarded as late magmatic, while limonitization of pyroxene is attributed to hydrothermal activity. The porous nature of the fourth flow in comparison with the other three flows has been inferred on the basis of specific gravity, porosity, and other physical properties.

A. P. S.

BOSE (M. K.). *On coronites from Koraput (Orissa)*. Sci. & Culture, 1959, **25**, 270-272.

Corona structures in a gabbroic anorthosite body at Koraput are described. The coronites, restricted to marginal portions of the body, display reaction rims in which garnet is the dominant mineral, with minor amounts of iron ores, biotite, and hornblende. The associated plagioclase is clouded and the garnet coronas are inferred to be post-clouding. The coronites are ascribed to slow annealing action of fluids and water vapour, after regional metamorphism under water-deficient condition aided by uniform pressure. [M.A. 14-307]

A. P. S.

VARMA (O. P.). *A note on the basic dykes and felspathic inclusions in them around the village Nausahi, District Keonjhar, Orissa*. Sci. & Culture, 1959, **25**, 324-325.

Some dolerite dykes in an ultramafic body NW of Nausahi village, carry coarse-grained aggregates of plagioclase. Their mode of occurrence, paragenesis, and origin are discussed.

A. P. S.

MURTHY (NARASIMHA C.), NAGANNA (C.), & SADASIVAIAH (M. S.). *Quartz dolerite dykes, from Shivahatti area, Dharwar district, Mysore State*. Journ. Geol. Soc. India, 1960, **1**, 144-151, 2 figs.

The rocks are attributed to a basic magma enriched in acid residuum and volatiles during fractional crystallization. Deuteric and hydrothermal alterations in the dolerite dykes are ascribed to the action of volatiles in the final stage of consolidation of the magma. New chemical analyses of quartz dolerites and optics of plagioclases and pyroxenes are detailed.

A. P. S.

DEB (S.) & CHAKRAVARTY (K. L.). *Trend of differentiation in the gabbro-anorthosite suite of rocks of Nausahi, Keonjhar district, Orissa*. Proc. Nat. Inst. Sci. India, 1960, **26A**, 427-435, 3 figs., 2 pls., 1 map.

Petrography and chemical analyses of a suite of gabbro-anorthosites and associated peridotites, pyroxenite, anorthosite, and granophyre, intrusive into Archaean quartz-mica schists, are reported. Chromite and vanadium-bearing titaniferous magnetites occurring in these rocks are regarded as late magmatic. It is envisaged that a basic magma gave rise to two primary differentiates, one resulting

in the development of peridotite and pyroxenite with chromite layers, while the other resulted in a gabbro-anorthosite, granophyre association, with magnetite.

A. P. S.

MORIMOTO (R.), FISHER (R. L.), & NASU (N.). *Bathymetry and petrography of the Bayonnaise Rocks, Japan*. Proc. Japan Acad., 1955, **31**, 637-641, 3 figs.

A chemical analysis is reported for the hypersthene augite-anorthite basalt which constitutes the Bayonnaise Rocks, lying at 31°55'3" N, 139°54'5" E.

A. P.

BAMBA (TAKEO). *Ultra-basic rocks of the Chugoku district, south-western part of Japan*. Journ. Fac. Sci. Hokkaido Univ., 1952, ser. iv, **8**, 65-73, 5 figs., 1 table.

Chromite deposits, serpentinites, and associated gabbroic rocks along the boundary between Okayama and Tottori prefectures are described. Chemical analyses are reported for a non-metasomatized gabbro and a spinel-pargasite-chlorite rock, presumed to have been developed from gabbro.

A. P.

ISHIKAWA (TOSHIO). *Xenoliths included in the lavas from Volcano Tarumai, Hokkaido, Japan*. Journ. Fac. Sci. Hokkaido Univ., 1953, ser. iv, **8**, 225-244, 2 pls., 3 tables.

Both accidental and cognate xenoliths occur in the lavas. Many types are distinguished and their distribution and relations to the enclosing rocks described. Accidental xenoliths range from non-metamorphosed shale to a cordierite-hypersthene-plagioclase-glass rock. Four chemical analyses of cordierite-bearing xenoliths and allied rocks are presented. Xenoliths considered to be cognate are characterized by hypersthene and plagioclase as the principal constituents.

A. P.

KATSUI (YOSHIO). *Petro-chemical study on the lavas from Volcano Rishiri, Hokkaido, Japan*. Journ. Fac. Sci. Hokkaido Univ., 1953, ser. iv, **8**, 245-258, 7 figs., 1 map, 5 tables.

This volcano constitutes a small island off the northwest coast of Hokkaido. Nine analyses of its products ranging from olivine-augite basalt to hypersthene-andesite are presented, together with norms, Niggli numbers, and a variation diagram. This series of lavas is compared with others by means of a number of graphs and shown to be relatively rich in Na₂O (2.76 to 5.14%) and poor in SiO₂ (49.26 to 66.41%).

A. P.

SUZUKI (YOSHIO). *Studies of variation in mineral compositions of some granodioritic masses in Japan and Korea*. Journ. Fac. Sci. Hokkaido Univ., 1953, ser. iv, **8**, 277-288, 5 figs., 5 tables.

63 modal analyses of granodiorite in the Inzan district, Iwate, and 44 of granodiorite in the Takata district, Japan, are reported. The areal distribution of the variants is shown on structural maps of the two granodiorite masses.

A. P.

YAMAZAKI (JUN). *On the rodingitic rocks within the serpentine masses of Hokkaido*. Journ. Fac. Sci. Hokkaido Univ., 1953, ser. iv, **8**, 419-430, 2 figs., 2 tables.

Rodingitic rocks occur widely as blocks or dikes in the serpentines of Hokkaido. They consist mostly of grossular and diopside with some zoisite. Idocrase may be present in veinlets and chlorite in marginal zones. Prehnite, feldspar, magnetite, and quartz occur only sporadically and in small amount. Two new analyses of rodingite from Kanayama, Ishikari province, representing the core and marginal zone are reported and compared with analyses of rodingites from New Zealand. The chemical relations of these rodingites, and of albitites and other leucocratic rocks associated with serpentinites are shown by plotting on an AF triangle and a variation diagram.

A. P.

YAMAZAKI (YOSHIO). *On the relations between the mineral and chemical compositions of some acid plutonic rocks in Japan*. Journ. Fac. Sci. Hokkaido Univ., 1953, ser. iv, **8**, 431-450, 5 figs., 6 tables.

The granitic rocks of two areas are dealt with: (1) those of the Osumi peninsula and nearby islands in the so-called outer zone of southwestern Japan, and (2) those of the Tsukuba district in central Japan. Three new chemical analyses of rocks from the former and numerous modal analyses of rocks from both areas are reported. These, together with many chemical analyses taken from the literature, form the basis for a discussion of the systematic relations of the rocks in both areas.

A. P.

YAMAZAKI (YOSHIO). *On the granitic rocks in Hokkaido*. Journ. Fac. Sci. Hokkaido Univ., 1957, ser. iv, **9**, 519-538, 18 figs., 3 tables.

Granitic rocks of Hokkaido may be classed geologically in four groups: (a) young granitic rocks intruded into the Tertiary formations of southwestern Hokkaido, (b) granodiorites intruded into the Palaeozoic rocks of southwestern Hokkaido, (c) granitic rocks intruded into the Cretaceous and pre-Cretaceous Hidaka formation of central Hokkaido, and (d) migmatite in the Hidaka metamorphic zone. About 90 modal analyses of the rocks of these four groups are presented and their relations shown with the aid of numerous graphs.

A. P.

YAMASHIKI (NAOKI). *Petrology of plutonic cognate ejecta from Nishi-Yama Volcano, Hachijo-jima, the Seven Izu Islands, Japan*. Japanese Journ. Geol. Geogr., 1958, **29**, 55-74, 6 figs., 1 pl., 8 tables.

Gabbroic and doleritic rocks are found as accessory fragments in basaltic scoria beds of Nishi-yama volcano; they represent slowly cooled facies of the basalts constituting the volcano. In these ejecta magnesian olivine and hypersthene crystallized first, followed by pigeonite and augite. Ferrohortonolite and ferroaugite crystallized last. Residual liquid precipitated a micropegmatitic intergrowth of tridymite and sodic plagioclase. One analysis of basalt from the wall of the volcano and three analyses of ejected fragments from the scoria beds are reported and compared with previously published analyses of similar material from this and other volcanoes.

A. P.

MATSUMOTO (HATAO). *Petrological study on rocks of Iwo-zima, Kagoshima Prefecture*. Kumamoto Journ. Sci., ser. B, 1954, **1**, no. 4, 96-107, 13 figs., 1 pl., 3 tables.

Nine chemical analyses are reported for volcanic rocks (olivine-pyroxene andesites and 2-pyroxene andesites) from the island of Iwo-zima [sulphur island] which is 10 km south of Kyushu. The microscopic characters of the rocks are described and the chemistry of the lavas and the volcanic activity on the island briefly discussed.

A. P.

MATSUMOTO (HATAO). *Petrographic study on rocks of Suwanose-jima, Kagoshima Prefecture*. Kumamoto Journ. Sci., ser. B, sect. 1, 1956, **2**, no. 1, 41-48, 3 figs., 5 tables.

Suwanose-jima lies 150 km southwest of Kyushu in the Tokara Archipelago and is known for its active volcano of the Strombolian type. Five analyses of lavas (SiO_2 59.49 to 60.21), 2 of a volcanic bomb, and 3 of volcanic ash are reported. Analyses and optical properties are also reported for plagioclase (An 50), hypersthene, and augite from the volcanic ash.

A. P.

MATSUMOTO (HATAO). *Petrological study on rocks of Tarawa-yama, Aso somma, Kumamoto Prefecture*. Kumamoto Journ. Sci., ser. B, sect. 1, 1956, **2**, no. 1, 23-39, 6 figs., 1 pl., 11 tables.

Tarawa-yama, formerly thought to be a parasitic volcano of the Aso somma is now considered to be related to an older volcano. It is built up of four flows of pyroxene andesite and hornblende-pyroxene andesite. Chemical analyses of these and of the groundmass of each are reported and the petrogenesis and its relation to the volcanic activity considered. The optical properties of all phenocrysts and of some of the groundmass minerals are recorded, and chemical analyses of the following minerals, occurring as phenocrysts, are reported: plagioclase An 58, hornblende (SiO_2 42.54%) and opacitized hornblende (SiO_2 30.01%), two augites, and two hypersthene.

A. P.

YOSHIZAWA (H.). *On the gabbro of the Cape of Muroto, Shikoku Island, Japan. Part I.* Mem. Coll. Sci., Univ. Kyoto, ser. B, 1953, **20**, 271-284, 5 figs., 1 map, 4 tables.

——— *Part II.* Op. cit., 1954, **21**, 193-212, 6 figs., 2 tables.

In part I the geological environment of this differentiated gabbro sill and the mineralogy of the essential constituents are discussed. An analysis of a monoclinic pyroxene from the gabbro (Wo 34.6, En 48.4, Fs 17.0; $2V\gamma$ 56-58°) is reported. In part II a dozen analyses of the several facies of the Muroto gabbro are reported and its magmatic differentiation and relation to similar rocks are discussed.

A. P.

ISHII (KIYOHICO), SENDO (TADAMASA), & UEDA (YOSHIO). *The diversity of the Tanohata granitic mass, northern Kitakami Mountains, Iwate Prefecture.* Sci. Rept. Tohoku Univ., 3rd ser., 1956, **5**, 153-167, 3 figs., 1 map, 7 pls., 2 tables.

The Tanohata granitic mass is classified into 6 rock-types, four of granodiorite and two of quartz-monzonite. Chemical analyses are reported for each, and also an analysis of an aplite which penetrates one of the quartz-monzonites. Norms, modes, and variation diagrams are presented and the features of each type discussed.

A. P.

ISHII (KIYOHICO) & UEDA (YOSHIO). *Tertiary granitic rocks in the northeastern Japan. I. (Granitic rocks occurred along the Ōoku Railway Line, Waga District).* Sci. Rept. Tohoku Univ., 3rd ser., 1956, **5**, 169-182, 2 figs., 4 pls., 3 tables.

Four chemical analyses of these granitic rocks (SiO_2 60.79 to 68.58%) are reported as well as the results of spectroscopic tests for Ba, Be, Cr, Cu, Li, Nb, P, Pb, Sn, Sr, W, Y, and Zn in each of the analyzed rocks and in several associated rocks.

A. P.

KUNO (HISASHI). *Geology and petrology of Ōmuro-yama volcano group, north Izu.* Journ. Fac. Sci. Tokyo Univ., 1954, **9**, 241-265, 6 figs., 1 pl., 3 tables.

Two new analyses of olivine-basalt and three of olivine-andesite with varying amounts of xenocrysts are reported. The difference in composition of the lavas of the Ōmuro-yama volcano group from those of the volcano Ō-sima, 30 km SE, is attributed to contamination.

A. P.

MUKAIYAMA (HIROMU). *Structural control and rock alteration at the Nishiazuma mine, Yamagata Pref., Japan.* Journ. Fac. Sci. Tokyo Univ., 1954, **9**, 271-286, 9 figs., 3 tables.

Platy bodies of sulfur and iron sulfides in volcanic rocks

constitute the ores of the Nishiazuma mine. Surrounding the high grade ore, sulfurized, pyritized, opalized, alunitized, and kaolinized rocks are zonally distributed. There is no evidence of volume change during the alteration. Seven chemical analyses are reported representing the original rock and successive stages in the alteration.

A. P.

YAMASAKI (MASAO). *On the chemical composition of lavas of Nyohō-Akanagi Volcano, Nikkō.* Journ. Fac. Sci. Tokyo Univ., 1954, **9**, 345-354, 2 figs., 1 table.

Nine chemical analyses of the lavas, mostly andesites, are reported together with modes and norms; it is concluded that the chemistry of the rock series is controlled by fractional crystallization as well as by contamination by argillaceous sediments underlying the volcano.

A. P.

RADIER (H.). *Contribution à l'étude géologique du Sahara oriental (A.O.F.). Tome I. Le Précambrien Saharien au Sud de l'Adrar des Iforas.* Bull. du Service de géologie et de prospection minière, Dakar, 1959, 304 pp., 11 pls. (photomicrographs).

A geological and petrographical study, with 73 chemical analyses, of the Precambrian basement of the eastern Sahara (Sheet: Tabankort). The lower Precambrian (Suggarian) is composed of gneiss, amphibolites, pyroxenites, charnockites, cipolins, and quartzites. Definition, occurrence, origin, and composition of the charnockites are discussed. Migmatitization affects all the Suggarian. The upper Precambrian (Pharusian) consists of parascists including flysch, schists, amphibolites, limestones, quartzites, and conglomerate, along with a great volcanic group comprising rhyolites, dacites, trachytes, andesites, basalts, and pyroclastics. Alkaline and calc-alkaline granites, granodiorites, and quartz-diorites traverse the two series.

E. J. & A. S.

LEGOUX (PIERRE). *Les péridotites de Conakry et du Kaloum (république de Guinée) et leur serpentinisation.* Bull. Soc. géol. France, 1960, 50-63.

The peninsula of Koulima is built of peridotites, dunites, and scarcer wehrlitic dunites, which present varying degrees of serpentinization. The mass is traversed by small dikes of serpentine, perhaps contemporaneous, perhaps later. Several minerals from the serpentines have been studied microscopically. The presence of a dyke of microaugitite in a boring near the Donka station is reported.

E. J. & A. S.

COX (K. G.), VAIL (J. R.), MONKMAN (L. J.), & JOHNSON (R. L.). *Karoo igneous activity and tectonics in south-east Southern Rhodesia.* Nature, 1961, **190**, 40 & 77, 1 fig.

In the Nuanetsi District, olivine basalts, tholeiites, and gabbros overlie Karroo sediments. These are intruded by layered gabbros, and finally by several acid ring-diorite intrusions. A late Karroo age is suggested for all the intrusive activity.

M. J. LE B.

WOOD (D. N.). *Karroo igneous activity and tectonics in south-east Southern Rhodesia*. *Nature*, 1961, **190**, 802-803, 1 fig.

The igneous rocks in the area between the Lundi and Sabi Rivers can be correlated with those of the Nuanetsi District [see preceding abstract]. The two intrusive complexes of Mutandawhe and Chiwonje consist of syenites and granites. The activity of these complexes has been responsible for Cu, Pb, and W mineralization in the surrounding basalts.

M. J. LE B.

SNELLING (N. J.). *The geology and petrology of the Murrumbidgee batholith*. *Quart. Journ. Geol. Soc. London*, 1960, **116**, 187-217, 6 figs., 1 map.

The Murrumbidgee batholith, of probable late Silurian or early Devonian age, crops out over an area of 550 sq. miles immediately SW of Canberra, Australia. It is a composite body in which nine separate components have been mapped, the rock-types ranging from tonalite to granite (*sensu stricto*). The order of intrusion was probably: contaminated granites (*sensu lato*), uncontaminated granites (*sensu lato*), leucogranites. The second are believed to represent the parental magma from which the first were derived by assimilation of sediments and, in one case, basic igneous rock. The compositions of the leucogranites place them in the 'residual system of petrogenesis' and they probably represent the residual liquids resulting from the crystallization of the other rock-types. Nineteen new analyses of rocks of the batholith, 5 analyses of xenoliths, 9 analyses of biotites (6 complete, 3 partial), and one analysis of hornblende are given.

B. C. M. B.

SAGATZKY (JEAN). *Contribution à l'étude géologique de l'île Espiritu Santo (Nouvelles Hébrides)*. 2. *Roches volcaniques*. *Bull. Soc. géol. France*, 1959, ser. 7, **1**, 588-593.

The volcanic assemblage of the north part of the island is formed of andesites containing augite, brown hornblende, and of labradorites, and augite-basalts. These lavas are often chloritized, uranitized, and calcified. They are accompanied by volcanic tuffs. The majority of the rocks are earlier than Miocene calcareous deposits.

E. J. & A. S.

FRICKER (P.) & WEIBEL (M.). *Zur Kenntnis der Eruptivgesteine in der Cordillera Vilcabamba (Peru)*. *Schweiz. Min. Petr. Mitt.*, 1960, **40**, 359-382, 2 figs., 1 map.

There are two groups of eruptive rocks in the Cordillera Vilcabamba (NW of Cuzco in south-eastern Peru): the Permian volcanic rocks of the Mitu group (mainly quartz-latites) and the younger intrusive rocks of the Tertiary or Upper Cretaceous Vilcabamba intrusion (mainly granodiorites). Eleven rock analyses are presented.

M. G.

COMPTON (ROBERT R.). *Charnockitic rocks of Santa Lucia Range, California*. *Amer. Journ. Sci.*, 1960, **258**, 609-636, 9 figs., 2 tables.

Much less abundant than the normal granitic rocks of the region, certain dark coloured, invariably allotriomorphic rocks consist largely of antiperthitic andesine, hypersthene, hastingsitic hornblende, ilmenite, and garnet. K/Ar determinations indicate a Cretaceous age for the normal granitic rocks and the charnockitic rocks may have formed in an earlier stage of the same plutonic cycle. The principal charnockitic pluton is intrusive but probably acquired its charnockitic character by late magmatic or subsequent processes. The metamorphic country rocks (Sur series) are in the amphibolite facies but have been converted to granulite facies in and, locally, near the pluton. Veins with granulite-facies minerals, formed at the same time as the pluton, are concentrated around it and are less hydrous than the rocks in which they occur. The close genetic relation of the various rocks is shown by the occurrence of certain mineral species and some aspects of their chemical composition. It is suggested that the charnockitization was produced by fluids that passed through the solidified part of the pluton and out into the country rocks, chiefly along fractures.

R. M. B.

LOVERING (J. KERRY) & DURRELL (CORDELL). *Zoned gabbro pegmatites of Eureka Peak, Plumas County, California*. *Journ. Geology*, **67**, 1959, 253-268.

Pegmatites in the pyroxenite of a gabbro-pyroxenite-peridotite complex of Permian age show zoning as follows from their walls inward: (1) coarse augite, (2) coarse plagioclase and augite (locally with hornblende and biotite), and (3) fine myrmekitic quartz and albite. After detailed consideration of alternative possibilities it is concluded that the complex and its pegmatites are products of normal differentiation in a cooling igneous intrusion.

R. E. W.

LYDON (PHILIP A.). *Geological section and petrography along the Poe Tunnel, Butte County, California*. *Spec. Rep. California Divn. Mines*, 1959, **61**, 18 pp.

About 60% of a 6.4 miles long tunnel is in serpentine (principally antigorite, serphophite, magnetite, and olivine), 35% in metamorphic rocks (produced by low-grade regional metamorphism), 5% in metagabbro, and less than 1% each of granodiorite, limestone, and blastoporphyrific amphibolite.

K. S.

ORVILLE (P. M.). *Petrology of several pegmatites in the Keystone district, Black Hills, South Dakota*. Bull. Geol. Soc. America, 1960, **71**, 1467-1490, 11 figs., 2 pls.

Three unzoned pegmatites in the vicinity of Keystone are peripheral to the Precambrian Harney Peak granite; two are concordant to schistosity and bedding of the Precambrian country rock, quartz-mica-schist, and the third is sharply discordant. Average compositions of the pegmatites and of the Harney Peak granite from two locations have been determined by weighting the individual compositions of the fine-grained groundmass and the perthitic megacrysts according to their measured relative proportions. The average modal and chemical compositions are similar and fall near the quartz-feldspar field boundary in the 'synthetic-granite' system; the average mode of both is approximately 30% quartz, 44 plagioclase, 17 microcline, 8 muscovite, and less than 1 tourmaline + garnet + apatite. Modal and chemical analyses are also given for four samples of quartz-mica-schist from the enclosing rock. At one locality thin, steeply dipping tabular pegmatites are sharply separated into an upper porphyritic perthite-bearing unit and a lower fine-grained albite-quartz unit. The upper has a composition near that of the 'granite minimum' in the 'synthetic-granite' system and is thought to represent a residual liquid which has been separated from the phases which crystallized earlier. The pegmatites and granite are believed to have been intruded as magma derived from a common source. A. L. A.

GULBRANDSEN (R. A.) & CRESSMAN (E. R.). *Analcime and albite in altered Jurassic tuff in Idaho and Wyoming*. Journ. Geol., 1960, **68**, 458-464, 1 fig.

The glass shards of an extensive layer of tuff in a marine limestone have been altered to analcime, with apparent addition of soda from sea water while interstices have been filled with microcrystalline quartz. A chemical analysis shows close similarity to that of a typical quartz keratophyre. At one locality the tuff has been converted to dense microcrystalline albite, presumably through an analcime intermediate stage, due to higher pressures and temperatures of deep burial. R. E. W.

POWERS (HOWARD A.). *A distinctive chemical characteristic of Snake River basalts of Idaho*. Prof. Paper U.S. Geol. Survey, 1960, **400B**, B298, 1 fig.

The rocks are lower in silica than those from other areas in northwestern United States; the silica generally decreases as the ratio of iron oxides to MgO increases. K. S.

SCHMIDT (ROBERT GEORGE), PECORA (W. T.), BRYANT (BRUCE), & ERNST (W. G.). *Geology of the Lloyd quadrangle, Bearpaw Mountains, Blaine County, Montana*. Bull. U.S. Geol. Survey, 1961, **1081-E**, 159-188, 1 pl., 1 fig., 1 table.

The igneous rocks range in composition from subsilicic-alkalic to silicic-alkalic and represent the shonkinite-syenite and monzonite families. Chemical analyses, by F. A. Gonyer, are previously unpublished [BERNARD FISHER, 1946, *Igneous rocks of the northeastern Bearpaw Mountains, Montana*; Unpubl. Ph.D. dissertation, Harvard University, 127 pp.]: A, mafic analcime phonolite; B, olivine-augite-nepheline shonkinite; C, augite-biotite syenite; D, augite-biotite latite; E, quartz latite vitrophyre.

	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO	MnO	MgO	CaO
A	50.34	0.76	10.32	3.04	5.90	0.09	12.58	7.40
B	50.38	0.58	10.20	1.90	6.28	0.09	14.78	7.28
C	58.22	0.72	15.40	3.26	3.36	0.09	3.30	4.82
D	59.80	0.47	15.63	3.10	1.50	0.08	3.28	4.76
E	67.32	0.24	14.72	0.96	0.86	0.09	1.11	1.86

	Na ₂ O	K ₂ O	H ₂ O-	H ₂ O+	CO ₂	P ₂ O ₅	SO ₃	BaO	Total
A	2.16	4.47	—	1.85	0.07	0.78	—	—	99.78
B	2.20	4.57	—	0.93	—	0.61	—	—	99.80
C	3.92	5.26	—	0.28	—	0.72	0.04	0.33	99.72
D	3.76	4.92	—	1.72	0.29	0.16	—	0.32	99.79
E	4.70	3.26	—	4.16	—	0.08	0.03	0.36	99.75

K. S.

JACKSON (EVERETT D.). *Primary textures and mineral associations in the ultramafic zone of the Stillwater complex, Montana*. Prof. Paper U.S. Geol. Survey, 1961, **358**, 106 pp., 92 figs., 10 tables.

The ultramafic zone, about 3500 feet thick, comprises the peridotite member consisting of conformably interlayered harzburgite, chromitite, bronzitite, and dunite and the bronzitite member consisting of a single thick layer of bronzitite. Three primary precipitate minerals—olivine, bronzite, and chromite—generally occur singly rather than in combination with one another. The bulk composition of interstitial material is nearly constant and approaches that of the chilled gabbro at the base of the complex. The textures, mineral associations, and cyclical rock distributions are due to continuous but variable-depth convection. [M.A. 14-460, 15-58] K. S.

HILLHOUSE (NEIL). *Preliminary report on the geologic investigation of the Roseland anorthosite and associated titanium deposits*. Virginia Journ. Sci., 1959, **10**, 293.

A brief discussion is given of the geology and genesis of the Roseland oligoclase anorthosite body which underlies an area of approximately 25 square miles in Amherst and Nelson Counties, Virginia. R. S. M.

STOUT (MARTIN L.). *Diabasic and gabbroic intrusions in the Frost Mountain area, south-central Cascade Mountains, Washington*. Amer. Journ. Sci., 1961, **259**, 348-352, 2 figs.

Two series of Tertiary basalt flows are present in the area. The older, Naches basalts are probably Eocene in age and the younger, Yakima basalts are Miocene-Pliocene in age. Some flows of each series can be traced into gabbroic

or diabasic intrusions, which are interpreted as feeders. Although the two groups of intrusions are similar in composition and texture, several petrographic features can generally be used to distinguish them: amount and degree of alteration of olivine; amount of glass and quartz; alteration of pyroxene; composition and alteration of plagioclase. Brief mention is made of the distinction of two generations in the nearby Teanaway dike swarm on the basis of similar petrographic features.

R. M. B.

BOYD (FRANCIS R.). *Welded tuffs and flows in the rhyolite plateau of Yellowstone Park, Wyoming*. Bull. Geol. Soc. America, 1961, **72**, 387-426, 11 figs., 6 pls.

The rhyolite plateau in Yellowstone Park consists of flows and welded tuffs with subsidiary rhyolite domes, basalt, and rhyolite-basalt mix-lavas. The younger Plateau flows occupy a tectonic basin rimmed by the Yellowstone tuff and older rocks. Individual flows range up to 1000 feet in thickness and cover areas up to at least 100 square miles. Surficial features including vent domes, are locally well preserved. The flows are predominantly layered obsidian and perlite and breccias formed by incorporation of fragments of pumiceous crust in the moving flows. Three new chemical analyses of the rocks are given. X-ray determinations of the composition and structural state of the K-feldspar are given. The Yellowstone tuff is welded to obsidian at its base and grades upward through indurated, lithoidal rhyolitic to loose ash at the top of an uneroded section. Probably all the Yellowstone tuff was erupted in a single series of eruptions from dispersed vents. Textural and structural evidence suggests that it was emplaced as pyroclastic flows. A thermodynamic analysis of this type of eruption is given, and energy changes within the conduit and during emplacement evaluated. The minimum temperature at which rhyolite glass will weld was determined experimentally as about 600°C. Welding in the Yellowstone tuff can be explained if the tuff was emplaced as pyroclastic flows and if the magma contained less than about 4% H₂O at the start of the eruption.

A. L. A.

MOORE (JAMES G.). *The quartz diorite boundary line in the western United States*. Journ. Geology, 1959, **67**, 198-210.

The eastern edge of the dominantly quartz diorite rocks of Mesozoic and Cenozoic age crosses the Canadian border near 120° W. Long., trends southeast through the west edge of the Idaho batholith, thence southwest across eastern Oregon and south along the western edge of the Sierra Nevada batholith in California. East of this line the analogous rocks are mainly quartz monzonite and granodiorite. The difference is attributed to differences in composition of the crust.

R. E. W.

HEINRICH (E. W.). *Sphene-allanite pegmatites of Griffith township, Renfrew county, Ontario*. Canad. Min., 1959, **6**, 339-347, 2 tables.

Four unzoned pegmatites in this area in eastern Ontario differ from many others nearby by being radioactive. They are 80-300 feet long, 5-15 feet wide. The main minerals are quartz, microcline, plagioclase, pyroxene, and sphene, and as accessories apatite and allanite. The radioactivity of the dikes is due mainly to sphene and allanite. The probable crystallization sequence is discussed. The unusual abundance of Ca-bearing minerals and the presence of Ti, Ce, PO₄, and CO₃ may have resulted from the assimilation of nearby dolomitic marble.

R. B. F.

THOMSON (JAS. E.). *MacLennan and Scadding Townships, District of Sudbury*. Geol. Rept. Ontario Dept. Mines, 1960, no. 2, 34 pp., 6 figs., 4 maps.

The detailed restudy of the east end of the Sudbury nickel area is continued in this report. The rocks, consisting of Precambrian volcanics, sediments, intrusives, and metamorphics are described in detail, with chem. analyses of rhyolite, quartzite breccia, and the matrix of the quartzite breccia. Ni-Cu, Au, Au-Cu, and U occurrences are briefly described. [M.A. 14-479]

J. A. M.

PARSONS (G. E.). *Niobium-bearing complexes east of Lake Superior*. Geol. Rept. Ontario Dept. Mines, 1961, no. 3, 73 pp., 33 figs., 5 maps.

A brief discussion is given of the mineralogy and geochemistry of the Nb-bearing, carbonate-alkaline complexes, with spectrographic analyses for Mn, Sr, Y, Fe, Ti, Ba, Ce, La, Nb, and chem. analyses for SiO₂, Al₂O₃, MgO, and Fe₂O₃, on carbonate samples from selected carbonatites. The four complexes described in detail range from predominantly carbonate to predominantly alkaline silicate types, and are summarized as follows: (1) ijolite, with in situ and injected breccias, and carbonatite dikes in country rock of granite with diabase dikes; (2) a dolomite core surrounded by calcite carbonatite, interzoned with biotite-pyroxene-calcite rock and country rocks of greenstone and granite; (3) nepheline syenite, surrounded by a fenite aureole, in gneiss; (4) several ring-zones of mafic silicate rocks enclosed in nepheline syenite. Nb occurs as pyrochlore and also in such associated minerals as aegirine and aegirine-augite in the fenite aureole.

J. A. M.

ROBERTSON (J. A.). *Geology of Townships 143 and 144 [District of Algoma]*. Geol. Rept. Ontario Dept. Mines, 1961, no. 4, 65 pp., 3 figs., 3 maps.

The stratigraphy, structure, and economic geology of part of the Quirke syncline of the Blind River area, District of Algoma, are described. Precambrian volcanics, pyroclastics, basic intrusives, and sediments are cut by Algomian

intrusions; Huronian sediments, including uraniferous, pyritic quartz-pebble conglomerate, follow and are intruded by Keweenaw diabase sills and dikes. Folding and faulting of the area occurred. The uranium ores in the area are believed to be of placer origin, with possible later modification.

J. A. M.

BARAGAR (W. ROBERT A.). *Petrology of basaltic rocks in part of the Labrador Trough*. Bull. Geol. Soc. America, 1960, **71**, 1589-1644, 20 figs., 5 pls.

Basalts and sedimentary rocks in the eastern half of the Labrador trough are intruded by numerous gabbro sills. The gabbros of the Ahr Lake area, Quebec, are divided into normal gabbros, 'leopard' rocks, and metagabbros. The latter, which are confined to the eastern part of the area, are equivalent to normal gabbros except for two varieties, leuco- and melanometagabbro. Normal gabbros sills have differentiated into olivine-bearing lower, and pegmatitic upper, portions. 'Leopard' rock is a coarse-grained feldspathic gabbro spotted with aggregates of altered plagioclase 6 to 15 cm across. Sills of 'leopard' rock have narrow zones of medium-grained, sparsely porphyritic gabbro along their margins, and some are composite with intrusions of normal gabbro along their centres. 'Leopard' rock is probably equivalent to normal gabbro with a high concentration of plagioclase. Petrographic and mineralogic data, with spectrographic and chemical data for 25 gabbros and basalts, are given. Normal gabbros are tholeiites which show an iron-rich trend similar to the Skaergaard trend but with negligible alkali enrichment. The basalts are equivalent to the parent magma of the normal gabbros. Low potassium and strontium are characteristic of the province. Trace-element behaviour is similar to that in other tholeiitic provinces. Metamorphism decreases westerly across the Ahr Lake area from quartz-albite-epidote-biotite subfacies of the greenschist facies through quartz-albite-muscovite-chlorite subfacies to subgreenschist facies rocks, which locally contain pumpellyite and prehnite.

A. L. A.

LACY (W. C.). *Geology of the Dunchurch area, Ontario, Canada*. Bull. Geol. Soc. America, 1960, **71**, 1713-1718, 1 fig., 1 pl.

This is a brief summary of the Grenville series in the Dunchurch area, Ontario, Canada, based on uncompleted geologic mapping done in 1940-41. Included are chemical and modal analyses of an amphibolite and of a plagioclase-hypersthene-hornblende-augite gneiss.

A. L. A.

WHEELER (E. P., 2nd). *Anorthosite-adamellite complex of Nain, Labrador*. Bull. Geol. Soc. America, 1960, **71**, 1755-1762, 1 pl.

An anorthosite-adamellite complex near Nain, Labrador, has intruded Precambrian gneisses which have a low

Na₂O/K₂O ratio and show many features of the granulite facies. Ultramafic rocks of Alpine type occur. Three facies of anorthosite and a fayalite, a hornblende, and a biotite facies of the adamellite are described; chemical analyses and modes are given for 2 anorthosite and 2 adamellite specimens. Adamellite margins change character near anorthosite and in places clearly show intrusive relations. Small intrusive bodies, showing affinities to either the adamellite or the anorthosite, occur commonly in gneiss zones involved with the anorthosite-adamellite complex. Variations in composition of rocks and minerals of the complex could result from repeated intrusion of magma evolving through differentiation by fractional crystallization, with the zone of intrusion migrating westward.

A. L. A.

Petrology; structure, petrogenesis

LECORCHÉ (JEAN-PAUL) & VON ELLER (JEAN-PAUL). *Orientation des plans de macles des minéraux de quelques roches des Vosges*. Bull. Serv. Carte géol. Alsace-Lorraine, 1959, **12**, 77-83.

The minerals used for measurement were feldspars, twin-plane (010), and amphiboles, twin-plane (100). Three types of rock were studied—the Crêtes granite, durbachites, microgranites and microsyenites. In the fine grained dikes the twin-planes are orientated generally following the direction of the dikes. In the granites and durbachites the twin-planes are orientated in a N-S direction.

E. J. & A. S.

BOISSONNAS (JEAN). *Sur la structure concentrique des granites jeunes traversant le Pharusien du Hoggar (Sahara Central)*. C.R. Acad. Sci., Paris, 1960, **250**, 4016-4017.

Porphyritic alkaline granites and biotite-monzonite form ovoid or circular masses with concentric structure.

E. J. & A. S.

BLOXAM (T. W.). *Pillow-structure in spilitic lavas at Downan Point, Ballantrae*. Trans. Geol. Soc. Glasgow, 1960, **24**, 29-52.

The form of the individual pillows has been studied and has led to the conclusion that they have reached their present position by rolling while still soft.

G. P. B.

REYNOLDS (DORIS L.). *Lapiés and solution pits in olivine-dolerite sills at Slieve Gullion, Northern Ireland*. Journ. Geol., 1961, **69**, 110-117, 3 figs., 1 pl.

The deep flutings and pits of the dolerite sills, previously attributed by Elwell [Journ. Geol., 1958, **66**, 57-71] to erosion of granophyric pipes, are regarded as due to simple solution weathering. It is concluded that the granophyric veins were intruded into brittle solid dolerite.

R. E. W.

HARRIS (A. L.) & RAST (N.). *The evolution of quartz fabrics in the metamorphic rocks of central Perthshire*. Trans. Edin. Geol. Soc., 1960, **18**, 51–78.

In an area of previously studied tectonic history, a sequence of mineral transformations has been related to the tectonic events. Various types of quartz girdles and maxima have been distinguished and, from a comparison of the changes in rock fabric during regional metamorphism with changes resulting from the working of metals, a new theory for the orientation of quartz in tectonites is proposed.

G. P. B.

SHIOKA (KÔKICHI) & SUWA (KANENORI). *Fabric of hornblende in a schistose amphibolite from the Kurobe-gawa area, central Japan*. Journ. Earth Sci. Nagoya Univ., 1954, **2**, 191–199, 2 figs., 2 pls.

The fabric of hornblende in plagioclase-amphibolite constituting a boudinage structure in the marble of Takadaki has been determined by the methods of Sander.

A. P.

WINKLER (HELMET G. F.). *La genèse de granites et de granodiorites à partir d'argiles*. C.R. Acad. Sci., Paris, 1960, **250**, 1088–1090.

Experimental results of the ultrametamorphism of calcareous, siliceo-illitic clays are presented and may contribute to the explanation of the formation of gneiss complexes, migmatites, granites, and granodiorites.

E. J. & A. S.

COGNÉ (JEAN). *Sur l'origine sédimentaire des porphyroïdes de Belle-Ile (Morbihan)*. C.R. Acad. Sci., Paris, 1960, **250**, 3350–3352.

These porphyritic rocks are derived perhaps from pyroclastic detritus or from gravelly arkose.

E. J. & A. S.

ELLER (JEAN-PAUL VON), BERNARD (JEAN-PAUL), & LECORCHÉ (JEAN-PAUL). *Mesure de la température de formation de quelques roches granitiques des Vosges par méthode de Barth*. C.R. Acad. Sci., Paris, 1960, **250**, 3859–3861.

The calculated temperatures fall in the ranges 610°–800°C for 10 magmatic granites, 490°–575°C for 9 metamorphic granites.

E. J. & A. S.

OFSTEDAHL (C.). *Volcanic sequence and magma formation in the Oslo region*. Geol. Rundschau, 1959, **48**, 18–26, 1 fig.

The Permian activity around Oslo started with abundant monzonitic rhomb porphyry lava flows intermingled with basalt. This stage produced a number of basaltic volcanoes and ended in explosive vulcanism, giving ignimbrites and

forming calderas. Below the lava surface larvikite, nordmarkite, and granitic rocks crystallized, the appropriate magmas having been formed by local melting of portions of the crust, allowing emplacement by stoping. [M.A. **14**–71, 211]

R. A. H.

SHIMAZU (YASUO). *A thermodynamical aspect of the earth's interior—physical interpretation of magmatic differentiation process*. Journ. Earth Sci. Nagoya Univ., 1959, **7**, 1–34, 20 figs.

— *A physical interpretation of crystallization differentiation of the Skaergaard intrusion*. Ibid., 35–48, 3 figs.

A method of estimating the physical conditions giving rise to magmatic differentiation, developed in the first paper, is applied in the second paper to the interpretation of the data of Wager and Deer [M.A. **8**–27, **15**–316]. A. P.

LARSEN (L. H.) & POLDERVAART (ARIE). *Petrologic study of Bald Rock batholith, near Bidwell Bar, California*. Bull. Geol. Soc. America, 1961, **72**, 69–92, 10 figs., 1 pl.

This paper reports a detailed study of 22 rocks from the batholith, including all the main rock types. Values for Qz, Or, Ab, and An calculated from measured modes show that the rocks fall along a trend slightly below the cotectic boundary between quartz and feldspars and directed toward this surface. Compositions calculated from the modes indicate that formation of the tonalites by contamination is possible, but requires improbably high proportions of metabasalt xenoliths in the rim of the pluton. Habits of zircons separated from the rocks show a distribution pattern which emphasizes contrasts between trondhjemitic core and granodiorite-tonalite rim of the batholith, but which does not support the idea of formation of the mantle rocks by contamination. Comparisons with the Bald Mountain batholith, Oregon, demonstrate many similarities as well as some striking contrasts.

A. L. A.

BYERS (FRANK M., Jr.). *Petrology of three volcanic suites, Umnak and Bogoslof Islands, Aleutian Islands, Alaska*. Bull. Geol. Soc. America, 1961, **72**, 93–128, 13 figs., 1 pl.

The petrology and chemistry of three volcanic suites on Umnak and Bogoslof Islands in the eastern part of the Aleutian Island arc are compared and related to tectonic position with respect to the axis of the arc. Analytical data include chemical analyses, modal analyses, densities, and optical data on constituent minerals of 36 specimens; spectrographic analyses on 19 of these; chemical and spectrographic analyses on a sample of constituent augite phenocrysts; partial analyses of constituent olivine and plagioclase phenocrysts and of two other rocks. The approximate chemical composition of the groundmass was calculated. Fractional crystallization was probably the

dominant process in the formation of quantitatively minor andesite and rhyolite masses associated with the basaltic shield volcano of northeastern Umnak. Andesitic agglomerate and subordinate rhyodacite ash associated with the caldera eruption of this volcano probably owes its composition to fractional crystallization, admixture with remelted basalt wall-rock, and assimilation of sialic rock. Most volcanic rocks of southwestern Umnak are similar in composition to the underlying plutonic rocks now exposed, and the presence of hypersthene in the andesites is related to their high aluminium content which was ultimately due to assimilation of aluminous sedimentary rocks. The slightly alkalic lavas of Boboslof became progressively less siliceous in successive eruptions from 1796 to 1927. A hypothesis genetically relating the petrochemical differences to tectonic position with respect to the Aleutian Ridge is outlined.

A. L. A.

WAGER (L. R.). *The major element variation of the Layered Series of the Skaergaard Intrusion and a re-estimation of the average composition of the Hidden Layered Series and of the successive residual magmas.* Journ. Petr., 1960, **1**, 364-394, 14 figs., 5 tables.

A knowledge of the shape of the Skaergaard intrusion, the composition of the initial liquid, and the compositions and relative volumes of the contrasted rock types, provide detailed information on the changing composition of a basaltic liquid under the conditions of slow cooling in a closed system. Because of the importance attached to such information, the earlier estimates [M.A. **8-27**, **11-495**] are now revised in the light of new chemical analyses of the chilled marginal gabbro and the layered rocks, and of new methods of interpreting the textures and crystallization history of the layered rocks in terms of cumulus and inter-cumulus material. Chemical variation diagrams include the plotting of major oxides against a revised structural height scale, and the plotting of TiO_2 and P_2O_5 against percentage solidified in order to demonstrate the likely volume of the hidden layered series and the relationship of volume to thickness for the upper zone layered rocks. A different method of obtaining the compositions of successive liquids is demonstrated by calculating the composition of the trapped contemporaneous liquid in a labradorite cumulate. The successive liquids are divided into fractionation stages which are compared with other magma fractionation trends. The relationship between the Ab ratio in plagioclase prisms and in the normative plagioclase of the contemporaneous liquid is compared with the solidus-liquidus relations obtained for synthetic An-Ab melts, and a similar comparison is made for the Fe : Mg ratio in the olivines. A revised classification and thickness scale of the Skaergaard layered series and upper border group are presented.

G. M. B.

Volcanology, etc.

JAMES (T. C.). *Helium and hot spring investigation—progress report.* Rec. Geol. Surv. Tanganyika, 1959, **7**, 64.

— *Analyses of natural gases and accompanying spring waters.* Op. cit., 1959, **7**, 104-106.

The flow of helium from springs in the Dodoma-Singida area and in the Musoma area varies from about 50 to 4 litres per hour. Sixteen analyses of gases, either He- N_2 (up to 16.2% He) or marsh gas (CH_4 , CO_2 , N_2), and associated hot spring waters are recorded. The waters are enriched in Na^+ HCO_3^- , and Cl^- .

D. McK.

JAMES (T. C.). *Occurrences of helium-bearing gases in Musoma and North Mara districts, Lake Province.* Rec. Geol. Surv. Tanganyika, 1959, **7**, 66-71.

KING (A. J.). *Geophysical investigation of the helium-bearing springs of eastern Lake Province.* Op. cit., 1959, **7**, 78-79.

The hot springs at Maji Moto, Musoma (135°F) emit about 200 litres per hour of gas containing 86.3% N_2 , 13.2% He, and at Nyamosi, North Mara (105°F) about 550 litres per hour of gas containing 81.2% N_2 , 17.9% He. The springs are fumarolic in nature and are located at the intersection of major fractures.

D. McK.

JAMES (T. C.). *Carbon dioxide-bearing hot springs in the Songwe River valley, Mbeya district.* Rec. Geol. Surv. Tanganyika, 1959, **7**, 73-77.

Eighteen hot springs (130-170°F), rising through vents in Pleistocene travertine, deposit tufa and emit gas rich in CO_2 (97.2, 99.2%). Analyses of a water and two gases are given. The springs are ascribed to fumarolic activity associated with the Rungwe volcano, or with the older volcano of the Panda Hill carbonatite.

D. McK.

FOZZARD (P. M. H.). *The Mponde River area, Singida district; quarter degree sheet 41 NW.* Rec. Geol. Surv. Tanganyika, 1960, **8**, 1-5.

A Precambrian migmatitic granite terrain in central Tanganyika is given preliminary description. The Mponde rift valley is the site of some He-emitting hot springs.

D. McK.

HARRIS (J. F.). *Geological investigations, sampling and diamond-drilling at Manyeghi helium-bearing hot springs, Singida District.* Rec. Geol. Surv. Tanganyika, 1960, **8**, 86-98.

KING (A. J.). *Geophysical investigations at Manyeghi hot springs.* Op. cit., 1960, **8**, 99-104.

Chloride-bicarbonate-sulphate brines and N_2 -He-Ar gases

ascend through a complex channel system along a fracture zone in Precambrian migmatite. The N_2 in the gases at surface is of atmospheric origin; the He and Ar are radiogenic or magmatic. The spring water is largely of meteoric origin. The migmatite is altered around the springs to a green montmorillonitic clay. Eleven gas analyses are given; they show N_2 89–93%, He 4.4–6.7%, Ar 1.2–1.6%, F_2S $>0.6\%$, CO_2 0.5–1.8%, CH_4 $>0.4\%$, O_2 $>0.4\%$, and F_2 $>0.8\%$.
D. McK.

JAMES (T. C.). *Analyses of natural gases and accompanying spring waters*. Rec. Geol. Surv. Tanganyika, 1960, **8**, 112–113.

Nine analyses are given, one from the Iramba Plateau, and eight from the Mponde River group of springs. The gases contain 87–92% N_2 with 0.74–10.2% He and 1.0–1.6% A. The brines have Na^+ , Cl^- , HCO_3^- , and SO_4^{2-} as the principal ions in solution.
D. McK.

MULT (W. U.), EATON (J. P.), & RICHTER (D. H.). *Lava temperatures in the 1959 Kilauea eruption and cooling lake*. Bull. Geol. Soc. America, 1961, **72**, 791–794, 2 figs.

The 1959 summit eruption of Kilauea Volcano, Hawaii filled the crater of Kilauea Iki with a lake of lava 365 feet deep. Temperatures of the erupting basalt ranged between 1060° and 1190°C. Temperatures down a 12.7 foot deep hole, drilled into the crust of the lake 5 months after cessation of eruptive activity, agree with calculated temperatures based on the heat equation. The cooling effect of rainfall is pronounced only in the upper 3½ feet of the crust. [Authors' abstract]
A. L. A.

SMITH (ROBERT L.). *Zones and zonal variations in welded ash flows*. Prof. Paper U.S. Geol. Survey, 1960, **354-F**, 149–159.

Ash flows may be emplaced at any temperature below a maximum eruption temperature. Below the minimum temperature for welding ('that process which promotes the union or cohesion of glassy fragments') no visible physical or chemical changes take place during cooling. Three distinctive zones are (1) no welding, (2) partial welding, and (3) dense welding. Three principal categories of crystallization which may take place during welding are devitrification, vapour-phase crystallization, and granophyric crystallization. Fumarolic alteration causes products which are different and which generally indicate lower temperature and lower pressure environments.
K. S.

MEDES (HARRY W.). *Early Tertiary volcanic geology of an area north and west of Butte, Montana*. Prof. Paper U.S. Geol. Survey, 1960, **400B**, B23–24, 1 fig.

K. S.

PAKISER (L. C.). *Volcanism in eastern California—A proposed eruption mechanism*. Prof. Paper U.S. Geol. Survey, 1960, **400B**, B411–414, 4 figs.

Volcanic eruption would be facilitated by reduction of confining pressure in areas of stress relief within the overlap of en echelon strike-slip faults.
K. S.

ROSS (CLARENCE S.) & SMITH (ROBERT L.). *Ash-flow tuffs: Their origin, geologic relations, and identification*. Prof. Paper U.S. Geol. Survey, 1961, **366**, 81 pp., 99 figs.

This treatise deals with all aspects of ash-flow tuffs: the history of the concept of their origin, detailed descriptions of their character and mode of occurrence, criteria for their recognition, terminology, distribution, and consolidation. Field relations presented for evaluation include extent, thickness, relation of overload to welding, jointing, erosional forms, inclusions of alien material, devitrification, and the relations to source centres. No exothermic source of heat is required for welding.
K. S.

[VLODAVETS (V. I.), editor] Влодавец (В. И.), редактор.

Проблемы геотермии и практического использования тепла земли [*Problems of geothermy and practical utilization of the heat of the earth*]. Изд. Акад. Наук СССР [Publ. Acad. Sci. U.S.S.R.], 1959, **1**, 255 pp., 92 figs. Price 15r. 60k. (old roubles).

This collection of twenty-two articles represents the first volume of the report of the first All-Union conference on geothermy held in Moscow in March 1956. Part I contains nine articles dealing with general problems of the thermal regime of the earth, those by I. D. DERGUNOV (pp. 2–16), E. A. LYUBIMOVA (17–26), B. N. DOSTOVALOV (27–30), E. N. LUYSTIKH (31–36), V. I. VLODAVETS (37–52), N. A. OGILVI (53–85), A. I. KHRABTOV (86–102), K. F. BOGORODITZKIĬ (103–111), and A. M. ZHIRMUNSKIĬ (112–115). Part II contains five articles on certain problems and methods of geothermy, and Part III contains eight articles devoted to regional geothermy of the U.S.S.R. S. I. T.

NEMOTO (TADAHIRO), HAYAKAWA (MASAMI), TAKAHASHI (KIYOSHI), & OANA (SHINYA). *Report on the geological, geophysical and geochemical studies of Usu Volcano (Showa-Shinzan)*. Rept. Geol. Surv. Japan, 1957, no. 170, 149 pp. (in Japanese), 83 figs. (with Japanese and English captions), + abstract of 24 pp., (in English).

The geochemical part of the study (abstract, pp. 18–20) dealt especially with the vapour from fumaroles and the equilibrium conditions of volcanic gases emitted. A. P.

POWERS (HOWARD A.). *Alkalic lava flow, with fluidity of basalt, in the Snake River plain, Idaho*. Prof. Paper U.S. Geol. Survey, 1960, **400B**, B297, 1 table.

K. S.

PECK (DALLAS L.). *Cenozoic volcanism in the Oregon Cascades*. Prof. Paper U.S. Geol. Survey, 1960, **400B**, B308-310, 2 figs., 1 table.

K. S.

TOPOGRAPHICAL MINERALOGY

VOKES (F. M.). *Contributions to the mineralogy of Norway*. No. 7. *Cassiterite in the Bleikvassli ore*. Norsk Geol. Tidsskr., 1960, **40**, 193-201.

A short description is given of the geology, and of the mode of occurrence and the textural relations of the cassiterite in the ore (pyritic lead-zinc ore). 38 ore samples average 0.04% SnO_2 (colorimetric determinations). Cassiterite was identified optically and by X-ray diffraction. The ore-forming minerals are, in order of relative abundance, pyrite, sphalerite, galena, pyrrhotine, and chalcopyrite. Molybdenite occurs as a very minor constituent in most of the ore (0.0028 to 0.0094% MoS_2 in 11 samples), and other sulphides, as yet unidentified, have been seen in polished section in even smaller quantities. Grains of scheelite were identified by means of X-ray diffraction but the ore contains less than 0.005% W.

K. S. H.

BLOXAM (T. W.) & PRICE (N. B.). *Stilpnomelane in North Wales*. Nature, 1961, **190**, 525-526.

Between Arthog and Dolgelly, stilpnomelane is very common, as radiating sheaves or 'bow-tie' aggregates, in the basic margins of the Cregennen granophyre sheet, in the associated 'markfieldites', and in some vitric tuffs of the Lower Llanvirn Bryn Brith Series. It is suggested that the stilpnomelane is the product of post-granophyre metasomatism.

M. J. LE B.

SARJEANT (W. A. S.). *An occurrence of stalactitic barytes*. Sorby Record [Sheffield], 1958, no. 1, p. 25.

The brown stalactitic barytes from Derbyshire commonly found in old collections came from New Haven mine, 3 miles SW of Youlgreave, long since abandoned. A temporary exposure (1955) is recorded from the opencast fluorspar workings on Masson Hill, Matlock, and has yielded stalagmitic barytes consisting of successive layers varying in colour from white through various shades to dark grey.

R. A. H.

DIETRICH (RICHARD V.). *Virginia minerals and rocks*. 3rd edition. Bull. Virginia Polytechnic Institute, Engineering Experiment Station Series, no. 137, 1960, 59 pp., 53 figs., 4 tables.

This handbook, written primarily for the younger student

and amateur mineral collector, describes common minerals, gems, and rocks, with special emphasis on those found in Virginia. Sections are also devoted to economic minerals in the State, as well as the scenic aspects of geologic formations. Also included are a list of over 320 Virginia minerals, mineral localities by county, and mineral determination tables.

R. S. M.

DIETRICH (RICHARD V.). *Virginia mineral localities*. Bull. Virginia Polytech. Inst., Engineering Experiment. Station Series, 1960, no. 138, 84 pp.

— — — *Supplement I*. Op. cit., 1961, no. 143, 31 pp.

Minerals not included in previous lists from Virginia include lepidocrocite, strontianite, celestine, moonstone, sunstone, delessite, stilpnomelane, cummingtonite, hastingsite, ferrian zoisite, pistacite and, in the supplement, calciostrontianite, bastnäsite, leonhardtite, epsomite, variscite, hydroxyapatite, and ammonium-bearing muscovite.

R. S. M.

BAETCKE (GUSTAV B.). *Identification guide to common minerals and rocks of Virginia*. Information Circular Virginia Divn. Min. Res., 1961, **3**, 51 pp., 2 figs., 9 pls., 3 tables.

This booklet describes over fifty common minerals and rocks, and a map of areas containing principal mineral localities in Virginia is included.

R. S. M.

MITCHELL (RICHARD S.) & PHARR (RICHARD F.). *Strontium minerals from Wise County, Virginia*. Virginia Minerals, 1960, **6**, 1-4, 2 figs.

A description is given of pale blue celestine crystals (up to $\frac{1}{2}$ inch long) and white calciostrontianite globules (up to $\frac{1}{2}$ inch diam.) which occur in dolomite near East Stone Gap, Wise County. Associated minerals include calcite (dog tooth spar), sphalerite, fluorite, glauconite, illite, quartz crystals, leonhardtite, and hexahydrite.

R. S. M.

LIEBER (WERNER). *Mineral and fossil areas in Germany*. Rocks and Minerals, 1961, **36**, 117-123, 1 fig.

Brief descriptions, including lists of minerals, and a map are given for over thirty mineral localities in Germany and nearby countries.

R. S. M.

OTHSTEIN (JOE). *Huge native copper nugget found in New Jersey at Bound Brook quarry*. Rocks and Minerals, 1961, **36**, 150, 1 fig.

A copper nugget, weighing 106 pounds, was recently found in a quarry in 'trap' located in Bridgewater Township, New Jersey. Analysis showed the presence also of silver and gold.

R. S. M.

ONES (ROBERT W., Jr.). *Collecting fluorescent minerals*. Rocks and Minerals, 1961, **36**, 151-153.

A description is given of the fluorescence of nearly thirty minerals found in the zinc mines in the Franklin, New Jersey, area.

R. S. M.

OUNG (VERTREES). *Rockhunting in Honduras*. Rocks and Minerals, 1961, **36**, 229-232, 1 fig.

Miscellaneous rocks and minerals were collected in Honduras. Near Olanchito were found jasper, chalcedony, petrified wood, serpentine, dolomite, rhyolite, conglomerate, reccia; near Tegucigalpa, sard, agate, petrified wood, jasper, epidote; near Yusecan, chalcopryite, galena, phalerite, gold, silver.

R. S. M.

IEGEL (LEO). *Jade found in Utah*. Rocks and Minerals, 1961, **36**, 236.

White, bluish-gray, and gray nephrite occurs as lenses associated with tremolite and talc in Millard County, Utah.

R. S. M.

ANON. *Rock capital of the nation*. Rocks and Minerals, 1961, **36**, 237.

A brief discussion is given of mineral localities in the vicinity of Dubois, Wyoming. Of special note are opalized and agatized trees up to 6 feet in diameter and 40 feet long; and amethyst-lined tree and limb casts.

R. S. M.

PERHAM (FRANK C.). *A find of rare pseudo-cubic quartz crystals in Maine*. Rocks and Minerals, 1961, **36**, 240-241, 1 fig.

Light-coloured smoky quartz crystals with a pseudo-cubical habit occur in pockets in a lithium-rich pegmatite at the Tamminen mine, Oxford County, Maine. The crystals are doubly terminated with short prisms and average $\frac{1}{2}$ inch in length.

R. S. M.

SMEDLEY (JIM). *New Mexico's Ora Blanchard mine*. Rocks and Minerals, 1961, **36**, 254-255 & 269, 1 fig.

Galena, cerussite, anglesite, linarite, selenite, and crystals of baryte, fluorite, and quartz occur near Bingham, New Mexico.

R. S. M.

VARIOUS TOPICS

TO (T.) & MORI (H.). *The symplectite problem*. Journ. Fac. Sci. Tokyo Univ., 1954, **9**, 201-204, 4 figs.

'Theoretical' triclinic lattice constants are computed for symplectite from the monoclinic constants for parawollastonite [M.A. 12-412] on the assumption that these polymorphs are structurally related in a manner similar to wollastonite and parawollastonite [M.A. 11-308, 14-326] and compared with the experimental values [M.A. 8-219].

A. P.

FINCHELL (HORACE) & TILLING (ROBERT). *Regressions of physical properties on the compositions of clinopyroxenes. I. Lattice constants*. Amer. Journ. Sci., 1960, **258**, 529-547, 6 tables.

Regressions of the lattice constants a , b , c , and β were calculated by the least squares method for 12 specimens of clinopyroxene, in which the compositions are represented by five independent variables in the pyroxene formula BC_2O_6 as follows: $x_1 = (Si)_c$; $x_2 = (Al, Fe^{III}, Ti)_b$; $x_3 = (Mg)_b$; $x_4 = (Fe, Mn)_a$; $x_5 = (Ca)_a$. The regression equations are symbolized by the general formula $y_p = \sum b_{ip}x_i \pm S_p$ where y_p represents each lattice constant, b_{ip} the applicable partial regression coefficients, x_i the relative number of certain metal atoms per 6 oxygen atoms, and S_p the

standard error of regression. The regressions can be used to: (1) estimate the unit-cell constants of clinopyroxenes; (2) estimate compositions that could produce a given set of lattice constants; (3) estimate lattice constants for compositions near to, but outside, the ranges covered by the authors' work; and (4) construct partial chemical variation diagrams showing lattice constants of clinopyroxenes. The satisfactory results of the study suggest that the entire clinopyroxene system can be represented by linear regressions of lattice constants. [M.A. 15-143]

J. A. S.

SHAFRANOVSKIĬ (I. I.). *Geometrical varieties of face forms for crystals falling in the classes of low symmetry*. Soviet Physics: Crystallography, 1960, **4**, 274-280, 8 figs., 4 tables. Translated from Kristallografiya, 1959, **4**(3), 293-301.

Geometrical varieties of face forms are deduced with allowance for positive and negative forms and for polyhedra with re-entrant angles, for crystals in the classes of low symmetry. [See following abstract]

A. P.

SHAFRANOVSKIĬ (I. I.). *Geometrical varieties of face forms for cubic crystals*. Soviet Physics: Crystallography, 1960, **4**, 452-459, 10 figs. Translated from Kristallografiya, 1959, **4**(4), 477-486.

The geometrical varieties of face forms for cubic crystals are deduced with allowance for positive and negative forms, for face sets, and for polyhedra with re-entrant angles. Many examples are given of real crystals showing these forms, mainly skeletal crystals and twins. A. P.

POBEGUIN (THERÈSE). *Giobertite et dolomite dans les concrétions 'mondmilch'*. C.R. Acad. Sci., Paris, 1960, **250**, 2394.

E. J. & A. S.

ROSENFELD (JOHN L.) & CHASE (ARMOND B.). *Pressure and temperature of crystallization from elastic effects around solid inclusions in minerals?* Amer. Journ. Sci., 1961, **259**, 519-541.

A generalization of the familiar practice of geothermometry by fluid inclusions is suggested for cases where stress (and strain) about a solid inclusion in a solid host mineral can be removed experimentally by change of temperature and pressure. The conditions necessary to achieve such removal determine a point on the curve of no strain in the *T-P* diagram for the given combination of minerals; if the characteristics of this curve are known or determinable, its intersection with the corresponding curve of no strain for some other pair of minerals from the same rock, will give the temperature and pressure of crystallization of the rock. Theoretical derivation of the necessary relations is outlined and several combinations of host-mineral/inclusion-mineral from kimberlite and eclogite are suggested as appropriate for initial studies. No experimental work is reported. For a start isometric minerals such as garnet, diamond, and spinel are more suitable than anisotropic ones.

H. W.

SKORUPA (JAN). *Résultats géologiques des recherches géophysiques au nord-est de la Pologne*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **2**, 182-188, 2 figs.

Magnetic, gravimetric, and seismic exploration in north-east Poland has yielded data for a map, showing the area of deep crystalline substrata and the shallower 'platform' area, together with indications of depth. R. A. H.

THOMAS (E.). *Strukturelemente im Norden der deutschen demokratischen Republik nach den Ergebnissen seismischer Refraktionsmessungen*. Rept. 21st Intern. Geol. Congr., Norden, 1960, Part **2**, 189-199, 1 fig.

Data from a seismic refraction map indicate a considerable thickness of Tertiary sediments with a small number of salt-plugs in the Prignitz district of Germany.

R. A. H.

GROSS (GERADO W.) & MOORE (E. JAMES). *Spontaneous polarization potentials and clay and limonite deposits in the Gatesburg formation of Central Pennsylvania*. Econ. Geol., 1959, **54**, 1056-1067, 8 figs.

A spontaneous polarization survey of lower Palaeozoic rocks in central Pennsylvania disclosed the existence of broad belts of negative potential associated with sandy and residual clay and limonite soils covering the Gatesburg formation. The anomalies, which have no relation to known sulphide deposits in the area, are considered to result from electrochemical potentials associated with clay-sand contacts and liquid junctions, where clay bodies lie along the contact between sandy layers of different ionic concentration. Resistivity profiles support the hypothesis. The method may be useful in prospecting for clay deposits in similar environments, and in locating geological boundaries.

J. A. S.

MALOUF (E. E.) & PRATER (J. D.). *Role of bacteria in the alteration of sulfide minerals*. Journ. Metals, 1961, **13**, 353-356, 4 figs.

It is shown that certain bacteria are capable of oxidizing pyrite to ferric sulfate and sulfuric acid and oxidizing copper sulfide minerals to copper sulfate. The importance of the use of these bacteria in waste dump leaching processes is pointed out.

R. G. Wls.

BAILEY (A. I.). *Friction and adhesion of clean and contaminated mica surfaces*. Journ. Appl. Phys., 1961, **32**, 1407-1412, 13 figs.

An apparatus is described in which it is possible to apply normal and tangential loads to sheets of mica covered with monomolecular layers of boundary lubricant. The surface energy of mica in air was measured by determining the force necessary to propagate a crack in the material. Cycles of opening and closing the crack were performed and the difference in energy observed is attributed to the adsorption and migration of an interfacial film of air or water vapour. An electron micrographic study of monolayers deposited by retraction from nonpolar solutions indicated that only about one-third of the total surface area was covered by the monolayer. The poor coverage arose from solvent molecules in the monolayer which later evaporated.

R. G. Wls.

GOODWIN (F. E.). *Maser action in emerald*. Journ. Appl. Phys., 1961, **32**, 1624-1625, 2 figs.

Successful operation of emeralds in a single-cavity reflection-type maser amplifier operating at 10 kMc is reported.

R. G. Wls.

ABBREVIATIONS AND SYMBOLS

used in the text of abstracts

M.M. .. Mineralogical Magazine : M.A. .. Mineralogical Abstracts : A.M. .. American Mineralogist

CHEMICAL & PHYSICAL-CHEMICAL

cation-exchange-capacity	c.e.c.
differential thermal analysis ..	d.t.a.
equivalent U_3O_8	ϵU_3O_8
ethylenediaminetetra-acetic acid ..	EDTA
heat of formation (absolute temperature subscript)	ΔH_f
ionic potential, e.g.	pH
insoluble residue	insol. res.
isotopes, e.g.	^{40}Ar , ^{40}K
loss on ignition	ign. loss
milliequivalent	me.
microgramme	μg
million-years	m.y.
not determined	n.d.
not found	nt. fd.
not present	nil
parts per million	p.p.m.
strength of solution, normal ..	N
— — — molar	M
substances in ionic state	
anions, e.g.	Cl^- , SO_4^{2-}
cations, e.g.	K^+ , Fe^{3+}
valency, e.g.	Cl^I , Fe^{II} , Fe^{III}

CRYSTALLOGRAPHIC & STRUCTURAL

Ångstrom unit (10^{-8} cm)	Å
crystal axes	a , b , c
— face indices	(hkl)
— form indices	{hkl}
— zone indices	[hkl]
indices of X-ray diffractions ..	hkl
intensity,	I
— relative	I/I_0
interplanar spacing	d
mica structural polymorphs ..	$1M_1$, $2M_1$
Siegbahn units	kX
space group. These words will be written in full	
unit cell, formula units	Z
— — repeat distances	a , b , c
— — reciprocal lattice lengths of edges	a^* , b^* , c^*
— — interaxial angles	
direct lattice	a , β , γ
— — — reciprocal lattice ..	a^* , β^* , γ^*

OPTICAL

dispersion, e.g.	$r > v$
extinction angle, e.g.	$\gamma : c$
optic axial angle	$2V$
— — plane	O.A.P.
refractive index, in text	refr. ind.
— — of isotropic mineral ..	n
refractive indices	
of uniaxial mineral	ω , ϵ
of biaxial mineral	α , β , γ
sign of biaxiality	
negative	— or $2V_a$
positive	+ or $2V_\gamma$

PHYSICAL (other)

calorie	cal.
calorie, large	kcal.
cycles per second	c/s
degree centigrade	$^{\circ}C$
density	D (quote units)
— , relative, e.g.	D_4^{20}
gramme	g
hardness	H.
melting-point	m.p.
micron (10^{-6} cm)	μ
millimicron (10^{-7} cm)	m μ
pounds per square inch	lb/in 2
soluble	sol.
specific gravity, terms of reference not known	sp. gr.
wavelength	λ

SYMBOLS

approximately equal to	\approx
equal to	$=$
equal to or greater than	\geq
equal to or less than	\leq
greater than	$>$
less than	$<$
not equal to	\neq
parallel to	\parallel
per cent.	%
per mille	‰
perpendicular to	\perp
proportional to	\propto

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